

New Jersey  
State Highway Department  
Administration

RECEIVED

JUL 19 1982

N.J.D.T. LIBRARY

A Review Prepared at the Request  
of the Commissioner of Highways,  
Dwight R. G. Palmer

NJ  
TE  
24  
N5  
N4  
1960  
C.1

AUTOMOTIVE SAFETY FOUNDATION



*Automotive Safety Foundation*

NEW JERSEY  
STATE HIGHWAY DEPARTMENT  
ADMINISTRATION

---

A Review Prepared at the Request  
of the Commissioner of Highways,  
Dwight R. G. Palmer

Automotive Safety Foundation  
200 Ring Building  
Washington, D. C.

NJ  
TE  
24  
N5  
N4  
1960  
C.1  
NJDOT RESEARCH LIBRARY



# Automotive Safety Foundation

DEDICATED TO EDUCATION AND RESEARCH FOR SAFE EFFICIENT HIGHWAY TRANSPORTATION

200 RING BUILDING • WASHINGTON 6, D. C.

April 15, 1960

Commissioner Dwight R. G. Palmer  
State Highway Department  
1035 Parkway Avenue  
Trenton, New Jersey

Dear Commissioner Palmer:

This volume contains nine reports covering our studies of State Highway Department functions in accordance with the agreement made with you September 15, 1958. This volume, and the separate report, "New Jersey Law and Highway Development," are in addition to the report, "Basic Highway Problems in New Jersey," prepared for public distribution.

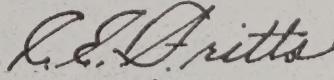
In our comments and suggestions we have sincerely attempted to be as helpful as possible, and to be strictly objective.

Will you please extend to all of your staff members involved our thanks for their cooperation. Their cooperation made it possible to complete our assignment.

Above all, we wish to commend you for your foresight in determining to have these studies made.

We hope the studies will be helpful. If we can be of further assistance, feel free to call on us.

Very truly yours,

  
C. E. Fritts  
Vice President in  
Charge of Engineering



## C O N T E N T S

	<u>Section</u>
<b>Introduction</b>	
<b>Organizational Structure and Personnel Problems</b>	I
<b>Planning and Programming</b>	II
<b>Design and Construction</b>	III
<b>Maintenance</b>	IV
<b>Organization and Administration of Traffic Operations</b>	V
<b>Land Acquisition</b>	VI
<b>State Aid</b>	VII
<b>Budget Practices</b>	VIII
<b>Public Information</b>	IX



## I N T R O D U C T I O N

In this volume, containing reports dealing with administrative problems, effort has been made by Foundation staff to suggest solutions which will enable the State Highway Department to increase its efficiency and to adjust its policies and practices to better meet the pressures of the rapidly increasing work load.

As shown in the separate report, "New Jersey Law and Highway Development," a variety of improvements in law would be extremely helpful to the Department. Those changes, plus administrative actions as recommended herein, should materially strengthen the Department, externally as well as internally.

This report, "New Jersey State Highway Department Administration," is not intended as a public report, since it covers problems which are solely administrative and do not require legislative action or public support. The law study, however, was prepared for possible use by the legislature.

The separate printed report "Basic Highway Problems in New Jersey," prepared for public distribution, provides a quick look at those elements with which the people at large are concerned and which generally require implementation by the legislature.

The three reports were made under the terms of the contract between the Commissioner and the Foundation, dated September 15, 1958.

The findings are presented in terms of conditions which existed during the study period, from October, 1958 through June, 1959. To the extent of staff knowledge, changes occurring since that time are recognized in the text.

I Organization and Personnel

II Planning and Programming

III Design and Construction

IV Maintenance

V Traffic Engineering



## ORGANIZATIONAL STRUCTURE AND PERSONNEL PROBLEMS

This section covers Foundation recommendations for reorganization of the Department, and major personnel problems and policies facing the Department. This report is based on a detailed study, over the last year, of the present organization and operating procedures.

Basic proposals and recommendations have been discussed at length with Department division heads and with a task force appointed by the Commissioner to determine how reorganization could best be implemented. Efforts to follow some suggestions in this report are already under way in the Department. However, they are presented here to complete the story of conditions as encountered by Foundation staff.

This report is intended only for the Department's internal use. Broad aspects of the organizational and personnel problems have been covered more generally in a separate report, "Basic State Highway Problems in New Jersey" prepared for public distribution.

Present situations found unsatisfactory result from several causes. Many deficiencies are of long standing nature and are so deep-seated as to be classed as traditional. In fact, many of today's problems are identical, or nearly so, with those existing 20 to 30 years ago. These problems are not new, for they were discussed in a 1941 report entitled "The Organization and

Administration of the New Jersey State Highway Department" by Sidney Goldmann and Thomas J. Graves.

To serve properly today's traffic and keep abreast of demands requires constant surveillance of the Department's organizational structure, management policies and personnel problems. Only by so doing can an optimum level of efficient administration and most prudent use of public funds be achieved. Although some attempts at improvement of organization have been made in recent years, no really significant changes have been effected. Review of organization charts dating back to World War II reveal that the internal structure of the Department has remained practically unchanged during the last two decades.

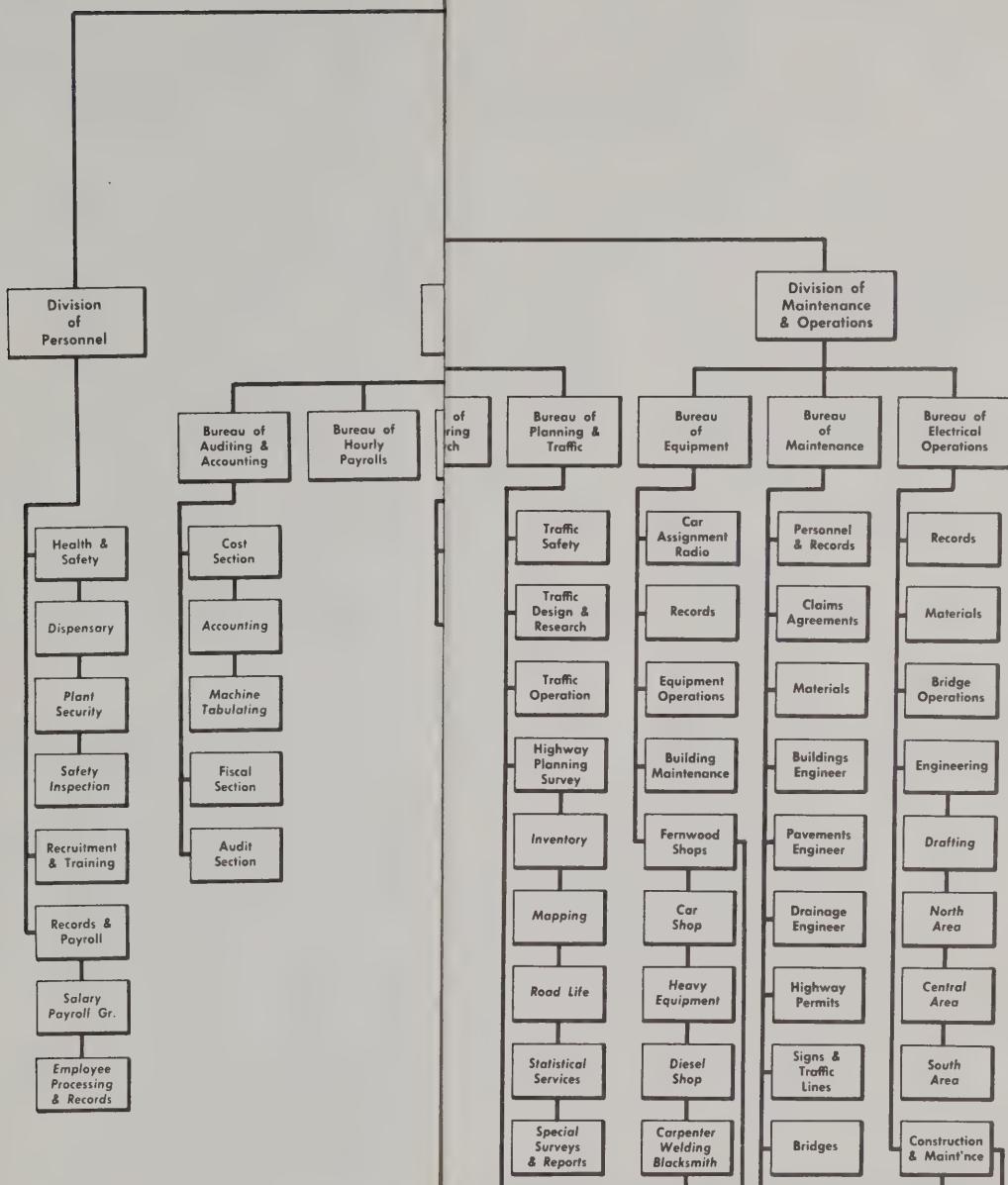
#### Present Organization

The Department is organized now into eight divisions which have 18 bureaus. Five divisions, involving engineering work functions, report through the State Highway Engineer. The other three divisions report directly to the Commissioner. (See the accompanying chart).

Each of the eight divisions exercises a high degree of autonomy, both in internal organization and in operations. This has resulted in a departmentalization of work functions which is exemplified in the lack of an integrated field organization. Each division's field offices are organized differently. In some cases differences exist even between bureaus of a single division. Boundaries of the 50-odd field offices have little in common, and in some cases are indefinite and subject to frequent change. Little, if any, attention has been given to coordination and consolidation of field activities between major bureau and divisions.

## ORGANIZATION OF NEW JERSEY STATE HIGHWAY DEPARTMENT

April, 1959



Administration of the New Jersey State Highway Department" by Sidney Goldmann and Thomas J. Graves.

To serve properly today's traffic and keep abreast of demands requires constant surveillance of the Department's organizational structure, management policies and personnel problems. Only by so doing can an optimum level of efficient administration and most prudent use of public funds be achieved. Although some attempts at improvement of organization have been made in recent years, no really significant changes have been effected. Review of organization charts dating back to World War II reveal that the internal structure of the Department has remained practically unchanged during the last two decades.

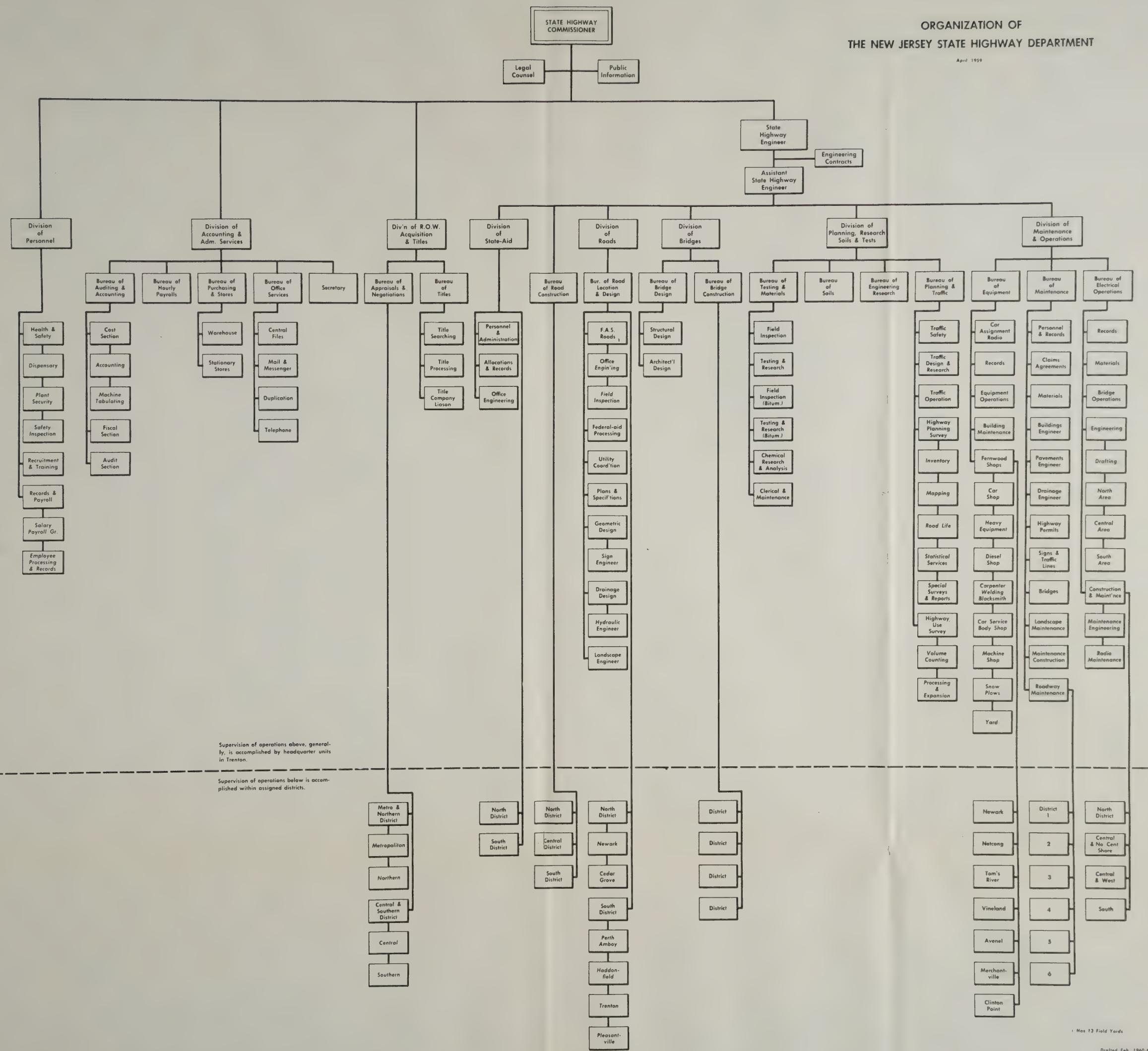
#### Present Organization

The Department is organized now into eight divisions which have 18 bureaus. Five divisions, involving engineering work functions, report through the State Highway Engineer. The other three divisions report directly to the Commissioner. (See the accompanying chart).

Each of the eight divisions exercises a high degree of autonomy, both in internal organization and in operations. This has resulted in a departmentalization of work functions which is exemplified in the lack of an integrated field organization. Each division's field offices are organized differently. In some cases differences exist even between bureaus of a single division. Boundaries of the 50-odd field offices have little in common, and in some cases are indefinite and subject to frequent change. Little, if any, attention has been given to coordination and consolidation of field activities between major bureau and divisions.

ORGANIZATION OF  
THE NEW JERSEY STATE HIGHWAY DEPARTMENT

April 1959





Lines of communications between the various field organizations are through the respective headquarters division staffs - a cumbersome and time-consuming process. As the Department has grown, and work load increased, it has become increasingly difficult for division and bureau heads to make necessary decisions promptly and follow through within their individual lines-of-command and, at the same time, properly coordinate and cooperate with others.

It is the consensus of Foundation staff that the present organizational structure of the Department is not conducive to top efficiency. There is definite need to decentralize authority and to unify field offices.

Reorganization Plan

The attached functional chart summarizes the form of organization of the Department recommended by the Foundation. It is based on the line and staff concept with policy functions handled at headquarters and actual operations conducted through district field offices responsible for all work functions in their areas.

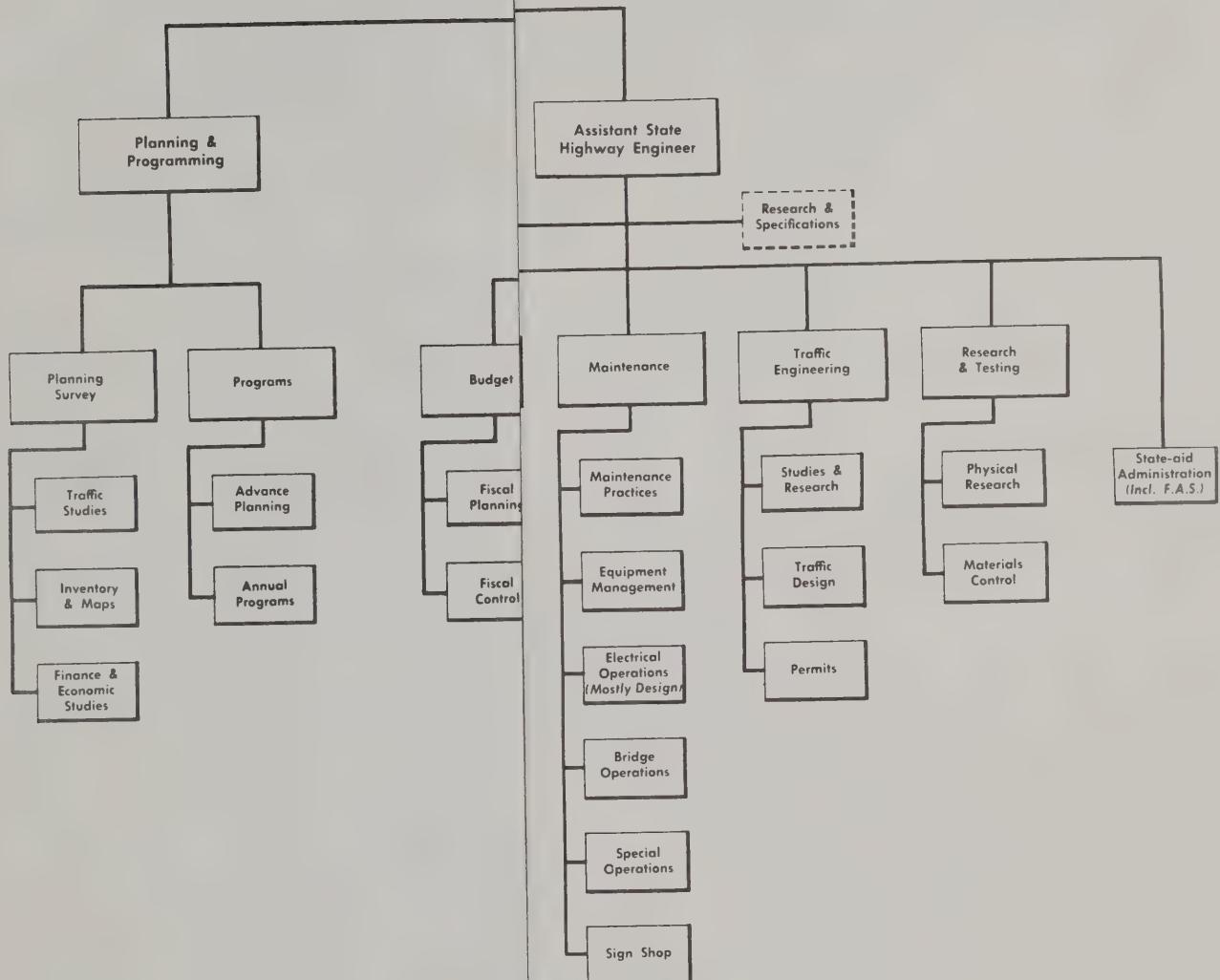
The line and staff form of organization is effectively used by large organizations, particularly those with a number of supporting specialist units for the principal action functions. Adoption of this type of organization gives greater flexibility, speeds up making of decisions, permits better use of personnel, and frees top administration from details of operation. The result should be, in the case of the Department, better service to the public. The line and staff form is predominantly used by state highway departments.

The line function is one in which authority and responsibility for command flow in a direct line from the chief administrative head to the lowest employee. At each administrative level the degree of authority and responsibility is more limited in scope than that of the level above it in the organization structure. Each executive is responsible for the actions of all those employees under him. Likewise, each employee has only one immediate supervisor.

The staff function is one in which responsibility and authority are confined to development of ideas, counseling and service. It does not include the authority to command nor to issue orders outside its own staff perimeters, but instead it provides information and knowledge upon which policies are established; policies within which the line organization gets the job done.

In application of line and staff principles to the recommended reorganization of the Department, the Foundation proposes a regrouping of all headquarters work functions into three principal categories and establishment of geographical operating districts for field activities with the responsibility for direct operations in each district assigned to a district engineer. The key to this plan is giving district engineers complete authority for district operations, subject only to Department policies and the direct "command-line" from the Deputy Commissioner - State Highway Engineer. This requires relinquishment of the direct line responsibilities now in the hands of division and bureau heads.

**FUNCTIONAL GROUPING OF WORK AREAS  
NEW JERSEY STATE HIGHWAY DEPARTMENT**

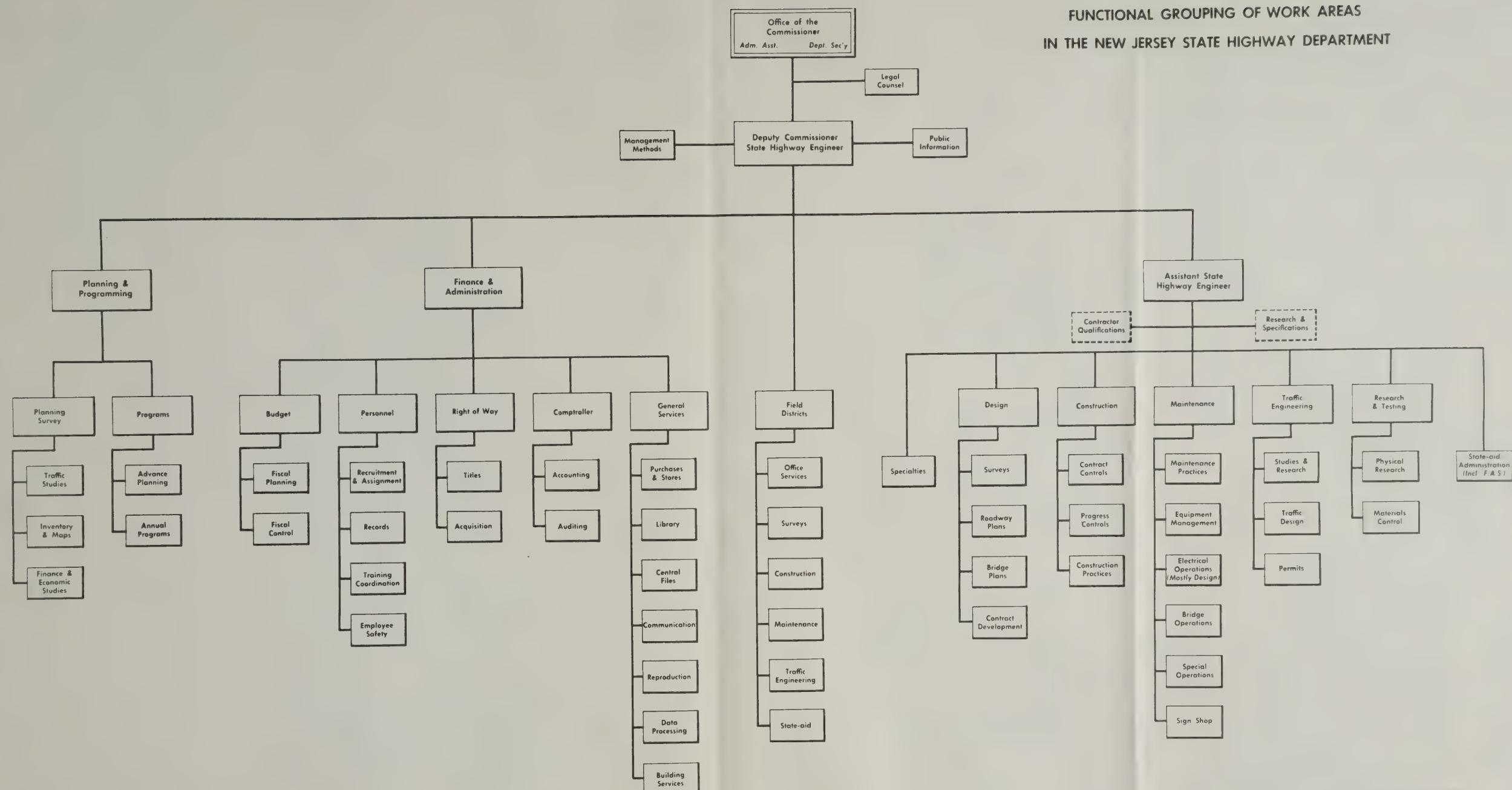


The line function is one in which authority and responsibility for command flow in a direct line from the chief administrative head to the lowest employee. At each administrative level the degree of authority and responsibility is more limited in scope than that of the level above it in the organization structure. Each executive is responsible for the actions of all those employees under him. Likewise, each employee has only one immediate supervisor.

The staff function is one in which responsibility and authority are confined to development of ideas, counseling and service. It does not include the authority to command nor to issue orders outside its own staff perimeters, but instead it provides information and knowledge upon which policies are established; policies within which the line organization gets the job done.

In application of line and staff principles to the recommended reorganization of the Department, the Foundation proposes a regrouping of all headquarters work functions into three principal categories and establishment of geographical operating districts for field activities with the responsibility for direct operations in each district assigned to a district engineer. The key to this plan is giving district engineers complete authority for district operations, subject only to Department policies and the direct "command-line" from the Deputy Commissioner - State Highway Engineer. This requires relinquishment of the direct line responsibilities now in the hands of division and bureau heads.

**FUNCTIONAL GROUPING OF WORK AREAS  
IN THE NEW JERSEY STATE HIGHWAY DEPARTMENT**





### Headquarters Reorganization

At headquarters level the proposed reorganization plan contemplates a major regrouping of work functions. As shown on the attached chart all engineering work functions would be assigned to an Assistant State Highway Engineer and all business and housekeeping functions to a Director of Finance and Administration. Those functions concerned with planning, long range program development and annual construction programs would constitute a third major grouping assigned to a Director of Planning and Programming.

Except for those functions where the line responsibility remains at headquarters (to be discussed later), duties of head office personnel will be concerned with development of policies, procedure and standards, and control of the quality of performance under those policies, procedures and standards and their good or bad effect on operations. This will involve advising and counseling District Engineers in the Department's field operations; preparation of manuals of procedure and standards, and general review of activities for compliance with established policies. It does not involve responsibility for supervision or command. It is extremely important that head office staff exercise constant care to avoid conflict with the command authority of the line functions. Otherwise the line and staff form of organization cannot operate effectively.

### The Commissioner's Office

The Commissioner, of course, has first responsibility and authority for constructing and operating the state highway system.

However, his principal activity should involve constant consideration of top policies which guide the activities of the whole Department. He should have the immediate support of the legal counsel for the Department and, some hold, the immediate support of the public relations office.

The Deputy Commissioner and State Highway Engineer is, in fact, the Commissioner's executive officer seeing that all policy decisions and the Commissioner's requests are transmitted in appropriate commands. Because of the predominant engineering nature of the Department's work the Deputy Commissioner should be a qualified highway engineer.

#### Management Methods Unit

This unit, for the most part, extends the work of the present Task Force which is studying ways and means of accomplishing reorganization. In continued practice, it would be a group constantly studying organizational relationships, needed changes in responsibility and authority and revisions in organizational manuals and directives. Because of the over-riding character of that work, the unit should be directly responsible to the Deputy Commissioner and State Highway Engineer.

#### Office of the Assistant State Highway Engineer

All engineering work functions at headquarters should be the direct responsibility of the Assistant State Highway Engineer. It is proposed that the various engineering functions be organized into five major divisions; Design, Construction, Maintenance, Traffic Engineering, and Research and Testing. In addition, an office of State-aid Administration and all staff specialists in engineering fields would report to the Assistant State Highway Engineer.

Design Division

It is proposed the Design Division be organized into four bureaus - Surveys, Roadway Plans, Bridge Plans and Contract Development.

The Surveys Bureau would be primarily a staff function. Actual survey work of all kinds would be a field responsibility. Activities of the Surveys Bureau would be concerned with preparation of procedural manuals and standards for survey work; collaboration with the Advance Planning Bureau of the Program Division in general location studies, particularly with respect to short range construction program needs; and operation of a Photogrammetry Section to service all needs of the Department, both field and headquarters, for aerial photographs, mosaics, etc.

Both the Roadway Plans Bureau and the Bridge Plans Bureau would essentially be line functions of the Design Division. It is not proposed that plan preparation be done at district office level. Foundation staff is of the opinion that concentration of all plan preparation at headquarters will tend to smooth out production peaks and valleys, promote greater efficiency and production of plans by Department forces, and permit better utilization of a data processing section in connection with design work. The consolidation and centralization of all plan preparation within a single division at headquarters represents a major shift from present operations. The Foundation believes this change is highly desirable for the reasons previously stated. In addition to plan preparation, these two bureaus will be responsible for review of roadway and structure plans for state-aid projects and for supervision and liaison with engineering

consultants retained for specific design projects.

The Contract Development Bureau would be responsible for cost estimating and preparation of special provisions and other documents preparatory to advertising of construction projects.

#### Construction Division

The Construction Division at headquarters should be organized into three bureaus - Contract Controls, Progress Controls, and Construction Practices. The Division would have no direct responsibility for supervision of construction. Instead all three bureaus would provide staff service and guidance to the districts with full responsibility for supervision of construction vested in the District Engineers and the District Construction Engineers.

The Contract Controls Bureau would be responsible for advertising lettings, issuing proposals, bid openings and all incidental work necessary to project awards and contract preparation and execution.

A Bureau of Progress Controls would establish procedures for handling of change orders, extra work orders, progress payments, final project approvals and payments, liquidated damages, contractors' claims and all other matters related to control of construction progress. This bureau would be responsible also for a general review of district construction activities for compliance with Department policies and procedures.

Duties of the proposed Construction Practices Bureau principally concern development of recommendations for establishment and changes in construction policies; preparation of general specifications and keeping them current with new technological

developments; issuance and periodic revision of standard construction manuals; and participation in the development and conduct of training programs as they concern employees of the Construction Division and district employees assigned to construction activities.

Maintenance Division

Most routine maintenance will be the direct responsibility of the District Offices. Some work of specialized nature, such as mud-jacking and bridge machinery repair, together with staff maintenance functions should be a headquarters office responsibility. It is recommended the Maintenance Division at headquarters be organized into six bureaus - Maintenance Practices, Equipment Management, Electrical Operations, Bridge Operations, Special Operations, and Sign Shop.

The Bureau of Maintenance Practices is a counterpart to the Bureau of Construction Practices. It should be responsible for development of general maintenance policies, preparation of procedural manuals and participation in conduct of training programs for maintenance employees exclusive of equipment operators and mechanics. It should review and consolidate requests for maintenance materials and supplies. In addition, this bureau should, as a staff service, prepare proposals and handle lettings, awards and agreements for contract maintenance. Actual supervision of contract maintenance work, however, would be a District Office responsibility.

Duties of the Equipment Management Bureau would primarily involve services for field operations. They should include acquisition of equipment parts and supplies, training of equipment operators and mechanics, studies of new equipment needs, and

development and revision of instruction and equipment operating manuals. Major equipment repairs should continue to be handled by the Fernwood shops as a part of the Equipment Management Bureau.

Headquarters duties of the proposed Bureau of Electrical Operations would mostly concern electrical design of highway illumination, lighted signs, traffic signals, etc. All installation and maintenance of such facilities would be a District Office responsibility.

The Bridge Operations Bureau should be responsible for formulation of policies, instruction manuals, etc. and training of operators. Responsibility for operation of movable bridges should be assigned to District Engineers.

There are some special maintenance activities, such as mud-jacking, resurfacings, minor betterments, etc, which can most efficiently be organized and handled on a statewide basis. These activities would be the responsibility of the Special Operations Bureau. They would consist of a line function handled by headquarters and will require coordination and cooperation with District Offices in scheduling and in performance.

Operation of the Sign Shop should continue as a headquarters responsibility. Installation and maintenance of signs should be handled by the districts.

#### Traffic Engineering Division

It is proposed that all traffic engineering functions now spread throughout several bureaus and sections of the Department be consolidated and that those traffic engineering functions

related to state highways now vested by law in the Division of Motor Vehicles be transferred to the Department and integrated with the recommended Traffic Engineering Division.

Duties of this division at headquarters level would be principally of staff nature and should be organized into three Bureaus, Studies and Research, Traffic Design and Permits.

Work of the Studies and Research Bureau would involve analysis and maintenance of traffic accident records, preparation of specifications and procedural manuals, recommendations for development, issuance and revision of traffic regulations, consultation with cities and counties on traffic engineering problems, and participation in training programs for Department employees engaged in traffic engineering work.

The Traffic Design Bureau would be responsible for studies and designs (geometric) of signal and sign locations and related traffic improvements such as intersection channelization.

The Permit Bureau would be solely concerned with policies, practices and regulations for permits of all kinds. Actual issuance and inspection of permits would be a field responsibility.

#### Research and Testing Division

While some physical research and testing work is related to planning, the majority relates primarily to engineering phases of design and construction. The Foundation recommends transfer of these activities to the proposed office of the Assistant State Highway Engineer and elevation of the work function to divisional status. The proposed division should be composed of two bureaus - Physical Research and Materials Control.

The Physical Research Bureau would primarily be concerned with direction and coordination of physical research programs, development and improvement of materials and processes and liaison with physical research conducted by others, in which the Department has an interest.

The Materials Control Bureau would provide services to the field districts and other Department bureaus in testing materials, soils engineering, and inspection of commercial concrete and asphalt plants, etc. This work primarily would be a headquarters operation based around the present testing laboratory facilities. There should be only limited material testing facilities at district level.

Office of State-Aid Administration

The Foundation strongly recommends that all field work of the present State-aid Division be incorporated with and made an integral part of the proposed district office operations. The growing responsibilities of the Department for leadership and cooperative effort with local governmental units cannot be carried out effectively as an operation semi-independent of all other Department functions.

To implement this proposal those state-aid functions concerned with program development and review, project approvals and operating procedures and policies, should be the responsibility of an Office of State-aid Administration reporting to the Assistant State Highway Engineer. All liaison with local governmental units together with supervision of construction should be a field responsibility.

### Engineering Staff Specialists

There is and will continue to be need for staff specialists in such areas as drainage, landscape, soils, utility coordination, right-of-way engineering, architectural, etc., to provide expert advice and guidance to both headquarters staff and to the field districts. It is proposed that all such specialists be assigned to the office of the Assistant State Highway Engineer. Their services deal almost entirely with engineering work functions and are primarily of staff nature.

### Finance and Administration

It is recommended that all business and housekeeping functions of the Department be consolidated under a Director of Finance and Administration and grouped into five major divisions; Budget, Personnel, Right of Way, Comptroller and General Services.

#### Budget Division

Under the Budget Division two Bureaus are proposed, Fiscal Planning and Fiscal Control.

Duties of the Bureau of Fiscal Planning would involve studies of revenue projections and future revenue requirements, coordination and consolidation of budget requests and finalization and presentation of annual budget requirements.

The Bureau of Fiscal Control would be responsible for budget supervision and operation, preparation of budget modifications as required to meet changing conditions and necessary negotiations with the State Budget Bureau.

Personnel Division

It is proposed that the Personnel Division be composed of four bureaus - Recruitment and Assignment, Records, Training Coordination and Employee Safety.

The Bureau of Recruitment and Assignment would be primarily responsible for liaison with the Civil Service Commission in the recruitment and appointment of Department personnel needs. They would participate in the determining of staffing requirements and conduct initial screening interviews with prospective employees.

Duties of the Records Bureau would involve maintenance of employee files and the processing and analysis of employee performance ratings. It is strongly urged that recent procedures for maintenance of employee records be converted to maximum use of available business machine processes.

This changeover should be accomplished regardless of whether the recommended reorganization of the Department is effected.

The proposed Bureau of Training Coordination would be responsible for general supervision of training programs. This bureau would participate in selection of employees for training purposes and, for those programs involving training in a number of work functions, would be responsible for assignments and transfers. Periodically all training courses should be evaluated, based on reports from the trainees as well as reports from staff responsible for actual conduct of the various programs.

Work of the Bureau of Employee Safety would be involved in development and supervision of all Department safety programs, maintenance of accident records, processing compensation claims and operation of the Department dispensary.

#### Right of Way Division

Duties of the Right of Way Division should be solely concerned with the business side of property acquisition and management. All engineering problems pertaining to determination of right of way needs, plat preparation, etc., should be handled by the staff specialists assigned to the Assistant State Highway Engineer. The Right of Way Division should be composed of two bureaus - Title and Acquisition.

The Bureau of Titles would be responsible for all title searches, whether made by Department personnel or by contract, and for processing and recording of deeds, etc.

The Bureau of Acquisition would handle property appraisals, negotiations, settlements, assisting in preparation of material for coordination proceedings and be responsible for management of property acquired for future highway use.

#### Comptroller

The Comptroller's office should be organized into two bureaus - Accounting and Auditing.

The Accounting Bureau should be responsible for maintenance of all needed general accounting records; for cost accounting and for payroll preparation.

The functions of the Auditing Bureau should include voucher audits and audits of all district office and state-aid accounts.

#### General Services Division

This division would include all general housekeeping functions of the Department as well as services of a general nature to other bureaus and field offices. It should be organized into seven bureaus as follows - Purchases and Stores, Library, Central

Files, Communications, Reproduction, Data Processing and Building Services.

The Bureau of Purchases and Stores would be responsible for handling of all Department requisitions for office equipment including review of specifications for such equipment, for acquisition of needed office supplies and forms, for liaison with the State Central Purchasing Bureau and for negotiation and handling of property rentals necessary to house Department operations.

The Library should provide a Departmentwide service in acquisition of periodicals and other materials needed by the various bureaus and field offices. It should maintain a current catalog of all available material in the Library and should provide research assistance upon request in the reference and briefing of available material on specific subject matter.

Central Files should be responsible for maintenance of all general Department files - correspondence, documents, records, plans, etc. This will be of increasing importance as more modern methods are used to reproduce and store records and documents.

The Communications Bureau should be responsible for receiving and dispatching all mail, including intradepartment mail, for telephone and teletype services and maintenance and servicing of the Department's radio network.

Functions of the Reproduction Bureau would provide service as needed to all Department units for duplication and printing by the most economical and feasible process.

Much of the work of the Data Processing Bureau will be in connection with engineering functions. The Bureau will provide services for all Department needs for mechanical and/or electronic data processing and appears most logically to be a function of the General Services Division for general administration purposes.

Building Services involve all necessary protection and janitorial services to the headquarters buildings, housing the Department's operations as well as building maintenance and alterations.

#### Planning and Programming

It is proposed that all planning and programming functions at headquarters be organized under two major divisions - Planning Survey and Programs.

##### Planning Survey Division

It is proposed that the functions of the Planning Survey Division be divided into three bureaus - Traffic Studies, Inventory and Maps, and Finance and Economic Studies. The titles of the three bureaus basically describe their duties.

The Traffic Studies Bureau would be concerned with continuing traffic counting programs, studies of travel patterns, vehicle characteristics and loading practices, conduct of origin and destination studies and other research studies related to traffic behavior and highway use.

Duties of the Inventory and Maps Bureau would involve the continual gathering, processing and analysis of geometric data and physical condition of highways, roads, streets and structures, maintenance of up-to-date records summarizing the results of such investigations and preparation and revision of maps showing the status of the highway plant.

The Finance and Economic Studies Bureau would be concerned primarily with continuing studies of highway finance, road life, motor vehicle, population, and travel trends and special economic impact studies and benefit cost analyses.

Program Division

The functions of the Program Division would be to apply the results of information from the various Planning Survey Division studies to the development of long range requirements for fiscal planning purposes and to development of annual construction programs. The work of the division should be organized into two bureaus - Advance Planning and Annual Programs.

Duties of the Advance Planning Bureau would involve the application and correlation of data gathered by the Planning Survey Division to problems of system classification and the character of and extent of long range improvement programs (including costs thereof) to provide adequate service for future traffic needs.

The Annual Programs Bureau would be responsible for determination, on a basis of priorities, annual construction programs for at least three to five years and for their periodic revision. This activity should extend to state-aid programs as well as direct Department programs. Activities of this bureau would also include development and preparation of reports covering the general character and geometrics of the programmed improvements, based on traffic demands.

District Offices

The proposed field organization is based on the establishment of geographical operating districts for all field activities with the responsibility for direction and supervision of all work

functions in each district assigned to a District Engineer. The District Engineers should report directly and only to the Deputy Commissioner - State Highway Engineer.

There are no hard and fast rules for determination of the number of districts which would be most effective for administration of field activities. Judgment alone suggests there should be no less than two, nor no more than four districts in view of the relatively small area of the state. The Foundation suggests consideration of four districts - one each for the Newark and Camden Metropolitan Areas and two essentially rural districts, one for the northern portion of the state and the other for the southern portion.

Regardless of the number of districts, be it two, three or four, each should be organized into six operating units, each headed by a principal aide to the District Engineer. These should be - Office Services, Surveys, Construction, Maintenance, Traffic Engineering and State-aid Liaison. The duties and responsibilities of each of the six principal aides would be to carry out the line functions of their respective specialities within the policies and procedures prescribed by head-office staff and approved by the State Highway Engineer and the Commissioner.

While district office aides will receive technical advice and assistance from their respective headquarters counterparts, it is emphasized that their responsibilities are to the District Engineer and to him alone. The District Engineer will necessarily resolve differences of opinion and coordinate work functions within his district. It is his responsibility, within basic Department policies and orders from the State Highway Engineer, to oversee and direct all Department operations assigned to his District.

Only under this concept, can the line-and-staff organization be fully effective.

## PERSONNEL

### Personnel Problems

In the course of this study, Foundation staff encountered employee problems concerning Department practices in classification of employees, nature and scope of promotion examinations, performance ratings, training programs and salaries. Also, it was evident that differences in procedures and thinking between the Department and the Civil Service Commission were causing disharmony.

Dissension in any organization can stem from lack of good coordination and communications between departmental units, delays in making decisions, and lack of clear-cut and progressive employee relations.

The proposed reorganization of the Department, with its orderly establishment of functions and operations, would do much to improve morale.

Another desirable step would be better communications -- keeping employees well informed not only on personnel policy and practices and changes but on program and fiscal problems. Periodic meetings of administrative and key personnel would provide a basis of understanding.

Similarly, meetings between Department and Civil Service Commission administrators, officials and supervisory employees would promote understanding and help establish procedures beneficial to employees.

Personnel Strength

Because the recommended reorganization plan will have a major effect on total personnel requirements, both as to numbers and position classifications, the Foundation did not attempt a detailed analysis of the Department's present personnel strength. No attempt was made to analyze clerical positions. Our discussions with various Department officials, together with our analysis of the Department's operations, support the following general observations and conclusions.

The Department has an adequate number, or even more than an adequate number, of maintenance workers, but is short on professional engineer and technical personnel. The most critical shortage is in the area of competent inspectors for construction operations and material control. The indicated surplus of employees in the Maintenance Division probably exceeds the total deficiency in employees elsewhere throughout the Department.

For a number of years the Department has sought authorization for additional personnel strength in each annual budget request. While a few modest increases have been granted from time to time, generally speaking the Department has not been successful in securing approval of requests for personnel increases, particularly for construction operations. There is evidence to indicate that the Budget Bureau feels the Department is overstaffed in comparison with other state highway departments.

The Foundation feels that the basic problem, as far as total personnel strength is concerned, lies in the apparent imbalance of personnel between divisions. Correction of this imbalance would

probably have a beneficial influence on securing Budget Bureau authorization for additional positions urgently needed elsewhere in the Department.

A separate section dealing with maintenance practices and policies, contains a more detailed discussion and analysis of maintenance personnel requirements.

#### Employee Classification

Among the 2,200 salaried employees of the Department, there are more than 250 different Civil Service classification titles - about half of which are single position titles of specialized character. Most of these single position classifications appear to be what normally would be considered organization or operating titles elsewhere - and not true classification titles. They have resulted largely from the static nature of the Department's organization over the years and the development of separate field and headquarters organizations for each major work function. This has progressively led to narrowing the scope of Civil Service examinations, both open and promotional, to more and more specialized fields and titles. There is also some indication that creation of single position classification titles has been used as a device for upward salary adjustments for individual employees.

#### Engineering Classifications

There are about 460 salaried positions in classifications with engineer titles. In addition, there are some 50-odd positions such as bridge designer, structural, bridge detailer, etc., which require engineering experience and some 280 positions in various technician and sub-professional classifications. The ratio of engineer positions to technicians is about 1 to 0.5 which is

extremely low in comparison with most other states. Nationwide the average is about 1 to 1.5 with a number of states operating in a ratio of 1 to 3 and upwards.

Of the approximately 460 engineer title positions, about 85 percent fall in the three lowest brackets - the so-called assistant, senior and principal engineer classifications, each of which have a number of parenthetical special titles. Many of the positions are not filled by engineers in the professional sense and this accounts in part for the apparent 1 to 0.5 engineer-technician ratio commented on previously.

An overlapping classification plan for engineering positions is needed, one series for professional engineers and one series for technicians and sub-professional.

Such a plan could be patterned on the salary and classification schedules recommended for state highway department engineers and technicians by the Committee on Administrative Practices of the American Association of State Highway Officials. The recommended AASHO engineer classification schedule is designed to cover only engineering graduates and registered professional engineers. Minimum qualifications for the first three engineer grades require a Bachelor of Science degree in engineering. Those grades are for the graduate engineer in training for professional registration. Minimum qualifications recommended for all higher grades require registration as a professional engineer but not necessarily an engineering degree, except for the top grade.

The technician classification schedule overlaps the engineer classification plan. Minimum qualifications for technician grades

do not require either registration or an engineer degree. The overlapping of the two classification schedules provides an avenue of advancement for the technician to enter the professional engineer field if and when he becomes qualified through registration.

Representatives of the Civil Service Commission have indicated a willingness to cooperate with the Department in development of a revised engineer classification plan along the lines discussed. This can be accomplished within the framework of present Civil Service law.

Should the recommended reorganization of the Department be adopted, a revised engineer classification plan will be essential to determine staffing requirements, particularly for district office personnel. Regardless of whether the recommended reorganization plan is placed in effect it is the consensus of Foundation staff that engineer position reclassification is an urgent need from the standpoint of efficient and optimum personnel utilization.

Transition from the present to a revised engineer classification plan of the character discussed will require time to develop and to conduct an examining program equitable to present employees. This may involve relaxation, or waiving, of some position classification requirements as far as present employees are concerned, to avoid disruption of Department operations. Any lowering of standards found necessary should only be applicable to the transition period, however, and should not apply to future open competitive examinations for engineer positions.

Paralleling this need for revision of engineering classification titles is the need for modification of Civil Service law

as it applies to promotional appointments from the top three eligibles of an employee list. There are some requirements for many engineer and high level technical positions which cannot be measured effectively by the examining programs of the Civil Service Commission. These involve attitudes, ability to make decisions, effectiveness of expression both in writing and speaking, ability to work with others and quality and rate of work production, to name but a few. Career employees who, from an administrative standpoint, are best qualified to fill a vacant position, are frequently not within the top three eligibles on the employment lists established as a result of promotional examinations and thus not within reach for promotion even though the particular position is one where administrative ability is of equal or greater importance than technical ability.

#### Personnel Records

The central personnel records of the Department consist of a personal history card and file folder for each employee. These show effective dates of personnel actions, classification titles, organizational units to which assigned and other information, but are incomplete or entirely omit other related data such as experience records, necessary for effective personnel administration. From the central personnel records there is no way to obtain summaries of employee strength by title, organization unit or personnel characteristics such as age, length of service, education, kinds of experience, etc., other than by manual tabulations, a burdensome and inaccurate procedure, to say the least. Because of this situation, the Department does not regularly prepare

summary reports of personnel strength or detail of personnel actions.

There is need for a thorough overhauling of personnel practices and for upgrading and strengthening of the Personnel Division. Personnel records should be maintained on business machine-type tabulating cards which permit quick and easy manipulation to obtain data necessary for efficient personnel administration.

#### Training Programs

Training programs for all classes of employees are becoming recognized as an important element of good highway administration. They are beneficial to management through increased efficiency and productivity. They help the employee through a better understanding of the purposes and reasons for the work he is doing and how it fits into the overall organizational structure.

The only organized training program in the Department is for new engineer graduates. This program involves rotation of the trainees to principal divisions and bureaus. It is based on a total period of six months which, in comparison with experience in other states, is too short a period for adequate indoctrination. The suggested highway engineer training program of the Highway Research Board Committee on Education and Training of Highway Engineering Personnel calls for a 24 month period of general training on all phases of highway engineering, followed by nine to 18 months of advanced training in a specialized area for which the trainee has shown particular aptitude and interest.

In addition to the Department's engineer training program, periodic schools are held for various classes of employees such

as technicians and maintenance supervisory personnel. These are in the nature of "short courses" conducted by Department personnel. They should be formalized, expanded in scope and content, and put on a continuing basis.

To meet the greatly increased highway program of the future, the Department will need to make greater use of subprofessional and technician personnel. Many state highway departments maintain a strong nucleus of subprofessional and technician personnel by conducting annual recruitment programs for high school graduates tied to an in-service department training program. Such training programs are designed to fit the individual department's organizational and geographical needs and vary in length from a week up to 18 months. A number of states make provision for tuition payments and other incentives for successful completion of training courses. This practice should be given consideration in New Jersey.



VI Land Acquisition

II Planning and  
Programming

III

Design and  
Construction

IV

Maintenance

V Traffic Engineering



## PLANNING AND PROGRAMMING

Collection, correlation and interpretation of basic highway and traffic data are essential for efficient and economical administration of a highway system. Unless such data are properly interpreted, administrative decisions are necessarily based on experience and judgment, often adequate, but also often not related to specific facts.

In New Jersey, the planning function needs to be materially expanded and reorganized, in view of the increased complexity of the highway problem and the larger amounts of funds being expended. Since the late Thirties, the Highway Planning Survey operations have been largely those required to satisfy requirements of the Bureau of Public Roads. While traffic information is fair, other data concerning highways are out-dated.

The last inventory of road and street conditions was undertaken in 1950; but six counties of the state were not covered. In 1959, a contract was let to redraft county maps based on those early data.

Fiscal data collection is limited to that necessary for compiling the state and local finance reports of the Bureau of Public Roads. More extensive origin and destination information is needed. Now data are limited to a few studies necessary for interstate cooperation. Generally speaking, the entire planning survey operation is geared to data collection with a minimum of subsequent processing analysis and interpretation necessary to the specific planning needs of the Department.

The attitude of the Department bureau and division heads toward the planning operation is not conducive to an energetic and imaginative attitude by the people in the Planning Survey. This is not peculiar to New Jersey and is unfortunately true in many other states where the older engineers in key positions prefer to depend on their experience, knowledge and judgment rather than basic planning data. The Foundation, of course, recognizes that in the final analysis the best planning data must be interpreted and modified by the judgment and experience of such engineers.

As an example, the Division of Roads developed the "Master Plan" and the estimates of costs to accomplish it, in 1957. Subsequently, the Bureau of Planning and Traffic developed the estimates of state highway needs required by the Congress in the Section 210 Study of the 1956 Federal-aid Highway Act. There was no correlation of these two estimates of the physical and dollar needs of the State Highway System, although both were made by the Department.

#### Needs Estimates

The Foundation review showed that both estimates needed revision and that the two estimates should be reconciled.

For example, the "Master Plan" listed these needed improvements:

Interstate System . . . . .	\$1.2 billion
Additions to 54 miles N.J.T.P. . . . .	.2
Other improvements - 1,552 miles . . . . .	1.6
Total . . . . .	\$3.0

Those improvements include construction of some 600 miles of freeway beyond the Interstate System. Generally, the freeways are located in open rural areas where new locations are feasible. As these freeways approach congested areas, design standards were curtailed to fit whatever space would allow.

The Section 210 Study contemplated improvements to 2,069 miles of state highway, exclusive of the Interstate System, at a cost of \$1.9 billion.

As part of this review, Foundation engineers, working with Department engineers, reconciled the two estimates. This resulted in an estimate of needed improvements covering 2,392 miles of roads for a total of \$1.6 billion. While the Foundation engineers would have preferred to have a considerably more solid base for an estimate, it is felt that this estimate is reasonable for present purposes in setting a target of needed improvements. However, progressively the estimates should be refined and periodically up-dated.

#### The Planning Function

The planning operation as presently conducted is not producing material in a form usable by the administrators which, undoubtedly, is the reason the administrators are not using it. Volumes of statistics and reams of straight line diagrams, maps and other data are in themselves of little value. Only when they are brought together, analyzed, interpreted and displayed in convenient form do they become working tools for determining which sections are inadequate and how much of the system is likely to become inadequate in the near future.

Annual construction programs are developed now largely on the basis of experience and judgment, wherein division and bureau heads concerned are canvassed as to their opinions on needed projects to be included in the next budget request. Of course, the amount for construction as approved in the budget and appropriated by the legislature dictates how many projects are finally included.

As pointed out in the full report "Basic Highway Problems in New Jersey," the year-to-year appropriations make long range planning extremely difficult.

The timing of legislative approval and subsequent appropriation also has an effect on Department operations in that starting plans and preliminary engineering ahead of time becomes somewhat of a gamble. However, there is no reason for these difficulties to preclude establishment and use of logical program selection procedures based on reasonable application of planning facts which should be available in the Department. The preponderance of construction jobs for any one year can be anticipated. In fact, in actual practice this is now being done.

Procedures of this nature already in effect in states have been described in several publications of the Highway Research Board; notably, Bulletins 53, 158, 194 and a soon-to-be published paper by James O. Granum and Clinton H. Burnes, presented at the 39th annual meeting, entitled "Advance Programming Methods for State Highway Systems." This latter paper is an excellent compendium of the better practices in use today.

Recommendations for Planning and Programming

The Foundation feels strongly that the planning survey functions should be taken out of the Division of Planning, Research, Soils and Tests and that it be re-established as a Division of Planning and Programming on an expanded basis, to carry on the true and needed functions of planning within the Department. The head of this division, together with the heads of Engineering, and Finance and Administration, would form the top policy group directly under the Commissioner and Deputy Commissioner-State Highway Engineer.

The Foundation recommends that the Planning and Programming Division should be under the direction of an engineer with knowledge of traffic studies and planning, but also with broad enough experience in the total highway field to warrant and merit the confidence of the administrators and other engineers of the Department. His immediate staff should include all disciplines needed for effective planning -- economists, researchers, statisticians, accountants, cartographers -- in addition to experienced highway planning and traffic engineers.







## DESIGN AND CONSTRUCTION

New Jersey's annual state highway construction program has averaged about \$30 million from 1952 through 1957. Increased Federal aid resulting from the 1956 and 1958 acts raised design work loads in 1958 and 1959 to \$74 million and \$108 million. This put the Department's design and construction work load in those two years at about the same level of total expenditures for major highway improvements as during the period 1950 to 1956 when the Turnpike and the Garden State Parkway were constructed.

Completion of the Interstate System and other required improvements to the State Highway System would require annual construction programs in excess of \$150 million -- an effort greater than those heretofore attempted. Estimated construction expenditures after this period would be in the neighborhood of \$60 million per year.

### Highway Design

Traditionally, the Department has done its own design work except for occasional highly specialized designs involving long span bridges, and the like. It appears that the present design staff is sufficient to handle about \$25 million per year in terms of construction cost. In 1958 and 1959 about \$135 million of construction work was let to design by contract engineers.

In general, the Department's force handles routine design work, while more complex freeway and interchange designs are let to contract engineers. This is shown in the table below.

Field Office	<u>By State Forces</u>			<u>By Contract</u>			<u>Total</u>
	Construction		<u>No.</u>	Construction		<u>No.</u>	<u>Construction Amount Millions</u>
	<u>No.</u>	<u>Amount Millions</u>		<u>Items</u>	<u>Amount Millions</u>		
Newark	6	\$ 3.7		5	\$22.2	11	\$25.9
Cedar Grove	5	3.0		3	2.0	8	5.0
Pleasantville	2	3.2		-	--	2	3.2
Trenton	4	.6		4	12.7	8	13.3
Perth Amboy	5	2.1		2	7.2	7	9.3
Haddonfield	4	2.4		4	7.2	8	9.6
 Total	26	\$15.0		18	\$51.3	44	\$66.3
Average Cost		0.58			2.85		
Percent	59	23		41	77	100	100

The table shows that the Department designs 59 percent of the projects involving 23 percent of the construction costs at an average construction cost per project of \$580,000. The construction cost of 18 projects designed by contract engineers averaged \$2,850,000.

#### The Department's Force

Department road design forces are dispersed through six field offices under two district engineers. For the most part, those offices do only detail work and drafting connected with producing construction plans. Actual design decisions are made in Trenton by the Bureau of Road Location and Design. What is gained by this dispersal?

#### Advantages

First, the headquarters building in Trenton under present

organization and operation could not accommodate all the field design personnel. Second, there are conveniences in having detail designers close to actual ground locations. Third, over the years design personnel have established homes near their assignments and would, now, resist transfer. Fourth, district offices are quickly available to contract engineers for discussion, even though many questions must be referred to bureau heads for decision.

#### Disadvantages

Designers in the field feel that because of dispersal through six field offices they handle only the small jobs. Both the fact and reason are borne out by analysis of the foregoing table. For instance, the Newark office handling six jobs at about \$600,000 construction cost each would find it difficult to take on a contract job of which the average is \$4.4 million.

Also, in each of the offices, slack time could be used to better advantage than in such routine tasks as inking "as-constructed" plans, etc.

However, if there were as much as 25 percent slack time, and it is probably less than 10 percent, in each of the district design offices, there would not be sufficient time for any of the district offices to take on the design of one of the larger jobs now let out to contract. Even so, Department field designers believe they are not being used to the best of their abilities and that they should receive more consideration in assignment of "glamour" jobs challenging their engineering skill.

### Modern Machines and Dispersion

It would be impractical to provide each of the six design offices with all of the mechanical, photographic and electronic devices available today to facilitate and refine the production of construction plans. Thus, the Department continues to follow the traditional methods of field location surveys, construction surveys, calculator computations, and the like.

Techniques and machines are available and in use in many Departments for determining suitable center-line locations and soil patterns from aerial photographs, for determining quantities through linkage between stereoptic plotters and electronic computers, for locating grade stakes in horizontal and vertical dimensions and for rapidly producing the multitudinous calculations required by bridge designers. (The Bureau of Bridge Design now contracts with outside agencies for some of these calculations.)

### Dispersion vs. Decision

Sufficient numbers of highly skilled and experienced roadway and bridge designers are not available to permit each district office to operate as an entity. Separation of those who do the detailed design and those who make fundamental design decisions leads to lost motion. Thus, under present organizational plan there will continue to be excessive communication between the detail designers in the field and the decision makers in Trenton.

### Recommendation

The Foundation is convinced that better operations would result if road location and design were centralized in the Trenton

headquarters, as is bridge design. Prompt decisions and immediate supervision would result in better and more efficient design by Department forces. Consolidation of forces would reduce waste time, now a complaint.

Centralized designing would make practical the use of modern machines and techniques to reduce hand operations and increase the production of the bureau. It is possible that through these methods, a relatively small increase in personnel would increase the Department's design production to the point where it could handle the normal work load -- around \$50 million to \$60 million per year.

This recommendation is not inconsistent with Foundation's recommendation for dispersing other activities of the Department. Construction, maintenance, traffic engineering and liaison with communities should be supervised where the work is. On the other hand activities such as design, research, laboratory testing, planning, etc., should be centralized in Trenton.

If this centralization were carried out in conjunction with the Foundation's other recommendations for reorganization, dispersal of field activities now handled out of Trenton would provide sufficient room in the headquarters building. District office personnel would be available for ground surveys and consultation with contract engineers.

#### Contract Engineer Services

The Department's handling of contract engineer services has been good. The rapid increases in funds available for construction

brought about by the 1956 and 1958 Federal highway acts made it imperative for the Department to employ outside engineers. The selection of engineering firms competent in the highway field has been good. Negotiated fees are in line with current practice for the type of work assigned. Actual work performed by contract engineers was found to be competent.

At least for the next 15 years the Department will face large construction programs. Although 15 years actually is not a short term program, it would not be feasible for the Department to gear its forces to produce \$150 million to \$200 million in construction plans a year. In addition to the difficulties of expanding forces four to eight times, the longevity guaranteed by civil service law and the investments in buildings, insurance and retirement funds make extensive expansion impractical. The Department should continue to contract that part of the design load in excess of the anticipated normal work load.

#### Construction

The Foundation has but two suggestions of significance with regard to actual construction work by contract. Achievements to date have been good. No untoward failures have happened. However, the Foundation is very much concerned by the shortage of engineering personnel actually engaged in the supervision and control of construction on the State Highway System. It is to the credit of the Department's hard working engineers and the high calibre of contractors' forces that failures have not occurred.

More field forces must be employed. In the meantime, administrative steps can be taken to relieve the situation.

Consolidation of the field forces of the Division of Roads and Division of Bridges would eliminate duplication of field crews. Naturally this would require additional training of both field forces but should be less difficult than training entirely new crews. This does not mean that on extraordinary bridges special bridge construction engineers would not be used.

Under the organization proposed by the Foundation all field crews would be under the direction of the district engineers. Thus, the seventy-odd inspectors now used by the Division of State Aid to control the work done by local communities (\$16 million in 1958) would be available also for inspection of the much larger work done by the Department.

#### Other Engineering Services

At present two organizations in the Department have equipment for mechanical data processing, the Bureau of Accounting and the Highway Planning Survey. These two agencies work independently and have duplicate equipment. Their service is restricted almost entirely to the parent bureau. It has been recommended that the Department obtain a digital computer for accounting services if a portion of the time and cost of such equipment could be assigned to other operations. At present only the Division of Bridges is interested in such a service and it has rented a computer service outside the Department.

#### Recommendations

The Foundation recommends that all data processing equipment be consolidated in one service unit; that procedures now in use be studied to determine optimum use of the machinery; and, that the Department obtain a computer for engineering and accounting computations.



VI Land Acquisition

VII State Aid

VIII Budget Practices

IV Maintenance

V Traffic Engineering



## MAINTENANCE

### Introduction

This report on the organization and functions of the Division of Maintenance and Operations covers conditions as found in late 1958, with appropriate comments about changes effected since that time insofar as the Foundation knows them. Earlier conditions are covered to furnish proper background for recommendations and to preserve findings for future study and consideration.

At the time the review began, a new division head had just taken charge and several subordinate changes had been made in supervision. Studies already were underway to effect organizational and operational changes subsequently recommended in this section. Many changes adopted were worked out cooperatively by the division staff and Foundation engineers. While many problems face the division, constructive activities are under way to do something about them.

In 1959, routine maintenance involved care of 1,833 miles of State Highways, including 36 million square yards of pavements, 17 million square yards of shoulder areas, 23 million square yards of roadside and drainage areas, 18 million square yards of planted areas which required fine mowing and plant treatment, and nearly 2,000 bridges of which 39 are movable. In addition to physical maintenance the division is responsible for efficient traffic operations involving snow and ice control, pavement markings, road signs, traffic signal installation and

operation, and operation of movable bridges. Other responsibilities include radio operations, vehicle fleet management, approval and inspection of driveway cuts, etc., construction and maintenance of institutional roads, and maintenance of the Delaware and Raritan canal bridges.

Work load in terms of expenditures for the fiscal year 1957-58 was:

(In millions)

Routine roadway maintenance	\$ 4.8
Extraordinary roadway maintenance	1.7
Landscape maintenance	.9
Bridge maintenance	.6
Snow and ice control	3.5
Signs and traffic lines	.7
Department force construction	.3
Institution roads and D. & R. C. bridges	.9
Drawbridge operation	1.3
Other Electrical Bureau	2.1
Miscellaneous and Division operations	.5
Total	\$17.3

The above amounts (Schedules 21 and 33, Fiscal Report 1957-58) assume that costs of the Bureau of Equipment have been approximately distributed to appropriate items through equipment rental charges.

Field operations were performed as follows:

Routine roadway maintenance	65 crews
Extraordinary maintenance & construction	14
Landscape maintenance	13
Bridge maintenance	7
Signs and traffic lines	9
Electrical operations	11
Permit inspection	9 inspec.
Bridge operations	305 tenders

Organization

In 1958, the division was organized into three bureaus: Maintenance, Equipment and Electrical Operations. (See chart in Section I). The Maintenance Bureau had three administrative sections, three staff specialists and six operating sections. The Bureau of Equipment had five operating sections centralized in Trenton although the Master Mechanic supervised both the main equipment shops at Fernwood and the seven district garages. Except for the assignment of bridge tenders and field electricians, operations of the Bureau of Electrical Operations were headquartered in Trenton. Decentralization of the supervision of the twelve electrical crews under four district superintendents was under way when the study started.

In all, routine road maintenance operations were assigned to six districts; landscape maintenance had 13 area assignments; equipment shops were assigned to seven areas plus Fernwood; electrical design, although accomplished in Trenton, had three district assignments; and electrical operations were divided among four areas. Bridge maintenance, bridge operations, highway permits, signs and traffic lines and Department force construction were statewide operations.

Obviously, there was no congruity in the field assignments, and little coordination of functions. This was evidenced by the location and type of housing used by the various bureaus and sections.

What is Being Done

Steps have been taken to consolidate all field activities

into four field districts headed by district maintenance engineers in line with over-all recommendations for Department reorganization. (See chart in Section I). This commendable effort may encounter difficulties and inconsistencies because of the lag in decentralizing other Department operations. It may be that district boundaries and district headquarters locations selected solely on the basis of maintenance operations would not coincide with those selected on a broader base of activities.

Personnel assignments are also affected. Delay in completing decentralization may result in assignment of personnel to district maintenance operations which, in the final view, might better have been assigned elsewhere.

Likewise the provision of buildings is affected. What size should they be? How should they be financed?

Because of lack of coordination of staff activities in Trenton, the division has found it necessary to employ engineering specialists for studies or building requirements and pavement and drainage maintenance. With only partial reorganization these specialized services must be performed solely within the division.

#### Personnel

Some 2,500 employees are in the Division of Maintenance and Operations most of whom, 1,700, are operating personnel in the Bureau of Maintenance. Next largest operation in terms of personnel is the Bureau of Electrical Operations with some 400 people. However, of this group, 305 are assigned to operation

of movable bridges. Others are the mechanics of the Equipment Bureau, radio personnel, clerical assistants, etc.

About 1,500 employees are paid by the hour. The remainder are salaried employees. Hourly employees receive overtime pay, salaried employees do not, except in cases of emergencies.

Problems with civil service regulations apply here as elsewhere in the Department. This is particularly true with regard to technical personnel and skilled mechanics and operators. All salaried employees are under civil service with little turn-over in their numbers. Also, the hourly employee force is fairly stable.

#### Number of Employees

Observations in the field and comments throughout the Department and elsewhere strongly indicate there are, now, too many maintenance employees, particularly in the laboring forces.

Some of these facts and observations are:

1. There is only slightly more than one center-line mile of road for each operating employee in the Maintenance Bureau.
2. The average assigned, adjusted work load per man in the maintenance crews, as determined in this review and discussed under "Operations," shows extremely wide variation throughout the state.
3. Numerous employee-days are spent salvaging materials for sheds, storage bins, etc.
4. Many man-days are spent sawing wood to provide heat for patrol offices.

5. Considerable hand sweeping and hand shoveling was observed.
6. Most movable bridges have one operator and two flagmen on duty. Bridge operations elsewhere in the country find mechanical gates and lights sufficient to protect bridge openings.
7. Mr. Vermeulen, State Comptroller, has questioned the total number of Department employees compared with similar operations in New England states.
8. The basic maintenance organization was established years ago before much of today's machinery was available.

Undoubtedly, these situations account, at least in part, for the ceiling the Budget Bureau has placed on positions in the Department and the difficulties encountered in attempting to expand the Department's technical organization. "No new positions allowed" appears to be the arbitrary rule.

#### Future Work Load

While Foundation staff is convinced too many employees are now in the laboring force, the increased maintenance load facing the Department now and in the immediate future precludes making an issue of the increased future work load. The Foundation estimates that, if the "Master Plan" is completed, area of pavement to maintain will increase 64 percent, shoulder area 35 percent, landscaped medians and roadsides 72 percent, and bridges 32 percent. Maintenance expenditures will increase to

about \$27 million. In fact, some of this increase is already appearing.

Every mile of the Interstate System complete and opened to traffic will require an annual expenditure of about \$17,600 per average mile as compared to the present statewide average of \$8,000. This reflects a considerable increase in the use of manpower, materials and equipment. Thus, within the space of a year or two, any existing excess in maintenance employees will be absorbed in increased work load. This will be the case if work-load studies continue to be used as the basis for assignment changes and need for replacements. In the meantime it would be unwise to waste the skill and training of present employees by cutting forces.

#### Equipment

The equipment fleet is generally well managed. Shops, except for Merchantville, appear adequately equipped and staffed to do the job assigned. Equipment viewed in the field appeared well maintained. Winter equipment was reconditioned and painted well ahead of season. This reflects, in part, the good effect of bonus payments for doing this type of work on Saturdays. However, there are difficulties.

#### Parts

Strict adherence to the purchase of new equipment according to low bid without regard to the complexities of over-all fleet management certainly complicates repairs and, particularly, parts replacements. Diversity of makes and year models results in the almost impossible task of maintaining a reasonable parts supply.

Without exception shops are inadequately supplied with spare parts. This has affected maintenance operations, particularly during emergencies. Lack of parts is a universal complaint among shop superintendents. This is borne out by observations and reports from the field.

For example, a Merchantville mechanic was observed trying to rivet together a generator fan rather than wait for a replacement because a truck was needed in service. During a snow storm two trucks in the Tom's River area were inoperative because they lacked ring seal replacements for differentials. Even small parts, such as spark plugs and fan belts, were in meager supply.

It could be argued that the effect of short supplies in the districts were offset by adequate supplies in Fernwood. Such, however, is not the case because Fernwood, too, reports an inadequate parts reserve.

Foundation staff believes that more productive use of manpower and equipment would result from such a simple thing as a better stocking of spare parts. While economies of competitive bidding are not to be denied, over-all costs must also consider those of adequately managing and maintaining the fleet. In this respect, parts supplies are of tremendous importance and must be considered in the selection of equipment and awarding of contracts.

#### Types of Equipment

Equipment seemingly in short supply are mechanical sweepers and loaders as judged by the considerable amount of hand shoveling

and sweeping observed. Admittedly, it would be almost impossible to eliminate all hand operations. Also, the more specialized the equipment the less it can be used in limited area assignments. However, consolidation of areas contemplated in the reorganization would permit the effective use of more labor-saving equipment.

#### Equipment Operators

While Fernwood attempts to provide operators for highly specialized equipment such as drag-lines and power shovels, it often has been impossible to do so. Placing expensive, complicated equipment in the hands of untrained or semi-trained operators is costly and hazardous. This is recognized and is being corrected. A program of field training of operators of special equipment is under way, with supervision by skilled operator and mechanic.

#### Buildings and Yards

There are about 100 yards and material dumps under the supervision of the Maintenance Bureau. For the most part, they are a disgrace to the Department and eyesores to the neighborhoods where located.

With few notable exceptions in recent months, they are built of materials salvaged from old barns, CCC camps, guard rails, railroad ties, etc. The reason: no budget approvals for new buildings.

This condition is not the fault of the division or any individual in it, but rather of the Budget Bureau or legislature for failure to provide funds for buildings. Almost

every foreman interviewed was ashamed of his surroundings and has done everything possible, even spending his own money, to improve facilities and appearances. Yards, themselves, were neat and clean. Everything possible to paint, was painted. Flowers were often planted to present a more pleasing appearance. In one instance, a manufacturer's dump was scrounged for broken asbestos shingles to cover the bare wood of shacks and sheds.

Only a few of the yards visited had water and toilet facilities. Some, but not all, had electricity. Only one had a telephone -- paid for by crew members. None was suitably equipped with a shop and small tools for minor repairs and implement sharpening. Heating facilities were usually makeshift adaptations of whatever could be found in someone's castaways. Office furnishings often gave impression of boxes, barrels and saw horses.

Some crews were able to scavenge materials to build sheds for storage of chlorides and cement. Others were able to build only tarpaulin covered bins. Only one yard had ramp loading facilities for a bituminous mixer with gravity discharge. Some yards had mechanical loaders, but many loaded materials by hand.

Some comparatively recent improvements were observed. Negotiations were under way for the purchase of a petroleum distributor's building and yards of the character needed to service maintenance crews and equipment.

#### What's Needed

Money, of course. But first, a real study of how many main yards and supplemental storage dumps are needed and how many

crews each can service. It should be determined how many material storage places are needed to minimize dead-haul. Needed, also, is a real analysis of what yards and buildings should do and how best to design for them.

Yards should be spacious and completely fenced against pilfering and vandalism. Areas subject to frequent vehicular and pedestrian traffic should be paved. Storage buildings should be of substantial fireproof construction and should be designed for mechanical or gravity in-loading and out-loading. Office and shop buildings should be of fireproof construction. They should be heated, lighted, and have toilet facilities. The office, in addition to usual office equipment, should be provided with telephone and radio, and facilities for coffee and snacks for those on stand-by duty during emergencies. The shop should be provided with a grease rack or pit, a washing pit, area and equipment for sharpening hand tools and making minor repairs, and storage for parts, signs, lubricants, paints, etc.

#### Operations

Regardless of the deficiencies in organization, personnel, buildings and equipment discussed earlier, the result of the maintenance operation is good. With few exceptions roads are in excellent shape, traffic devices although out-moded are well maintained and storm conditions are handled promptly and efficiently.

The division contracts for some maintenance operations with good results. Notably, these are: bridge painting, edge line stripping, snow plowing and installation of electrical

conduits for traffic signals. Advance planning of work and materials by staff in the central office seems good as does the investigation of new techniques and materials.

Recently three engineering specialists were added to the staff in Trenton; one to study the problems of buildings and yards, another the problems of pavement maintenance and one to study drainage conditions. Although the reorganization proposed by the Foundation suggests these specialists be assigned directly to the Assistant State Highway Engineer, the autonomous operation of the divisions makes it necessary to continue these assignments within the division until reorganization is affected.

Foundation staff believes strongly that the operation of the division would benefit greatly by increased engineering activity of that character and by greater use of engineers in supervisory positions. Also, it is believed that all new engineers in the Department should put in a stint in the Maintenance Division to achieve proper perspective toward building and operating a highway system. Those two suggestions, of course, go hand-in-hand.

#### Work Load Assignments

During the course of the review the Foundation set up and the division head approved an inventory of work areas. To our knowledge this was the first such inventory ever attempted. The results were good and the division is to be complimented on the thoroughness of its effort to provide solid information on which to base an analysis of work assignment.

Each crew foreman under the supervision of the maintenance supervisors and the landscape maintenance supervisor measured

and reported the areas of pavement by type, shoulders by type, medians, roadsides, interchanges, and bridges. These data were combined with information on age of pavements, traffic volumes and traffic types to produce a work load index per man in each crew. Several attempts to assign weights to each work unit were made until supervisory personnel were satisfied that a workable empirical formula was obtained. The final formula used was:

$$\left[ (PF_{pt} F_a \times SF_{st}) F_t \times R \right] \times F_v \times \frac{1}{N} \text{ equals work load index}$$

Wherein:

P - Pavement area in 1,000 square yards

F<sub>pt</sub> - Factor for pavement type:      P.C.C.    1.0  
    B.C.      1.5  
    Sur. Tr. 2.0

F <sub>a</sub> - Factor for pavement age:	B.C.	P.C.C.
0 to 5 years	0.3	0.3
6 to 10 years	0.6	0.5
11 to 15 years	1.0	0.8
16 to 20 years	1.5	1.0
21 to 25 years	2.0	1.3
26 to 30 years	2.5	1.6
Over 30 years	-	2.0

S - Shoulder area in 1,000 square yards

F<sub>st</sub> - Factor for shoulder type:

Shoulder Type

Lane Width	High	Surf. Treated	Untreated
12 feet	1.0	4.0	5.0
11 feet	1.1	4.3	5.1
10 feet	1.2	4.5	5.2
9 feet	1.4	4.8	5.3

R - Area of rough mowing in 1,000 square yards

F<sub>v</sub> - Factor for traffic volume:

A. D. T.	F
Under 2,000 v.p.d.	0.8
2,000 to 5,000 v.p.d.	0.9
5,000 to 10,000 v.p.d.	1.0
10,000 to 30,000 v.p.d.	1.2
30,000 to 40,000 v.p.d.	1.3
Over 40,000 v.p.d.	1.5

F<sub>t</sub> - Factor for truck volume and weight:

Trucks	F
Low truck density	1.0
Medium	1.5
High	2.0
Very high	3.0

N - Number of men in crew

A summary of the results of this appraisal for each of the six field districts is shown in the table at the end of this section.

The range in adjusted work load per man for each of the 66 routine maintenance crews is shown in the chart following the table. It will be noted that adjusted work load indices vary from a low of around 50 units per man to more than 500 units per man. While no claim is made that these measurements are precise, it is obvious that, even allowing for considerable error of judgment, some field crews produce a lot more work per man than do others.

In fairness, it must be pointed out that, as soon as the results of the analysis were compiled, the Supervising Engineer began the adjustment of work loads by transferring employees where feasible and by refusing to fill vacancies on crews having low work load indices.

As pointed out, the impending increase in total maintenance work will give further opportunity to balance assignments and absorb excess field personnel which might now exist.

The Foundation hopes that as these indices are used studies will be continued and refined. One immediate refinement could be inclusion of the area of fine mowing done by landscape forces. Such areas were not included in original formulae because areas were not compiled according to the same job numbers as was routine maintenance. The recent consolidation of routine and landscape maintenance forces under the same supervision should make it easier to include these additional data in further considerations.

The bureau is commended for its businesslike attitude toward equity in the assignments of work loads.

Summary of Recommendations

1. Reorganize the division into a staff-and-line operation as much as action independent of other division permits.
2. Continue study of work load assignments, using such studies as the basis for transfers and replacements until more uniformity in assignments is achieved and until excess laboring forces is absorbed.
3. Give more precise study to the economies of equipment purchases related to makes and types and the need for adequate parts supplies. There must be a factual balance between honest and competitive first costs and the additional costs of maintaining the fleet.

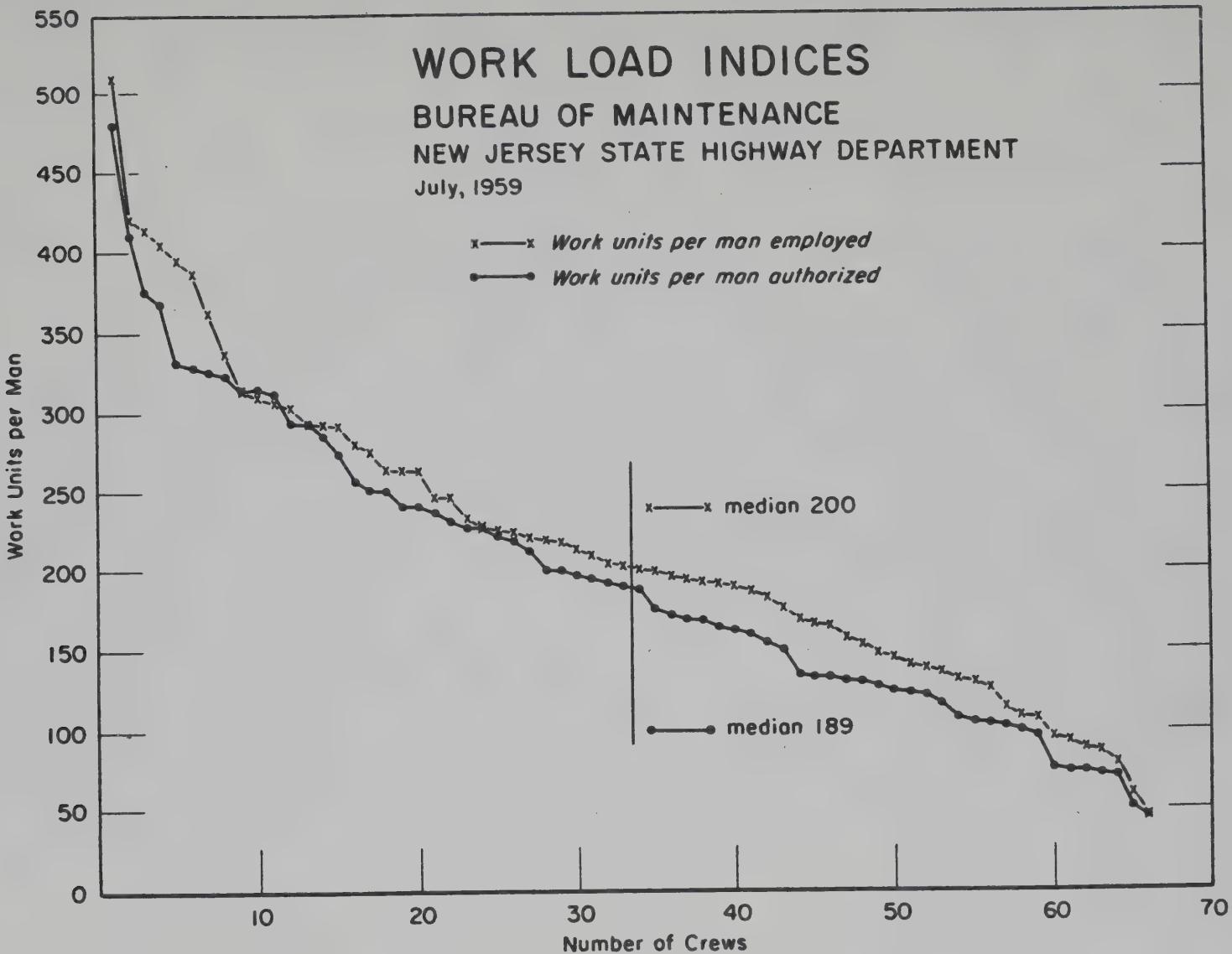
4. As reorganization progresses, study the advisability of providing mechanization as a substitute for much of the hand labor now used.
5. Establish a general plan for main yards and supplemental material dumps and a general design for each. Specific study should be given to actual mechanical needs of each yard to reduce the amount of hand loading, to provide proper vehicle maintenance facilities and to give space and equipment for small tool maintenance.
6. Use more engineers in the planning and supervision of maintenance operations.

**SUMMARY OF MAINTENANCE WORKLOAD INDICES**

JULY, 1959

DISTRICT	Pavement 1,000 SY	Adjusted Pavement 1,000 SY	Shoulders 1,000 SY	Adjusted Shoulders 1,000 SY	Adjusted Pavement & Shoulders 1,000 SY	Adjusted P & S & Truck 1,000 SY	Adjusted Traffic Volume 1,000 SY	Total Mowing 1,000 SY	Final Adjusted 1,000 SY	Manpower Quota	Manpower Actual	Work Index Per Man Quota	Work Index Actual
1	4,313	6,856	1,869	8,168	15,094	19,082	22,588	3,437	26,025	175	161	149	162
2	7,230	9,080	1,550	4,985	14,015	28,212	38,018	1,090	39,108	179	158	218	247
3	6,739	8,470	3,420	15,910	24,665	33,923	38,017	4,610	42,627	181	150	236	284
4	4,903	7,014	2,746	12,579	17,693	23,519	24,600	4,485	29,085	191	177	152	164
5	5,680	7,922	3,004	13,919	21,817	27,518	29,290	2,489	31,779	176	173	180	183
6	6,513	9,206	4,727	21,138	29,144	31,941	33,151	6,935	40,086	150	152	267	265







VI Land Acquisition

VII State Aid

VIII Budget Practices

IX Public Information

V Traffic Engineering



ORGANIZATION AND ADMINISTRATION  
OF  
TRAFFIC OPERATIONS

Since 1955 the New Jersey Highway Department has greatly accelerated its traffic operations program; nevertheless, there remains a serious backlog of operational needs. The expanded construction program continually adds to the backlog. The Department is in a precarious legal and administrative position to meet the accumulated demands.

The essentiality of the traffic operations function to safe and efficient highway operations is recognized by responsible highway officials everywhere. Most highway facilities, appurtenances, traffic controls and equipment can be financed with Federal-aid funds on the same basis as construction. Furthermore, operating measures often are an alternate to construction and reconstruction or are an integral part of each alternative. Thus, they become an essential consideration in the expenditure or allocation of highway funds. The power to employ them in the public interest is indispensable to the highway administrator.

An Adequate Program

An adequate traffic operations program should include:

1. Preparation and administration of the policies, practices and standards with respect to control, regulation and guidance of traffic on the highway system.
2. Continuous observation of the highway system to identify those locations where appropriate levels of safety and convenience are not realized.

3. Engineering studies of physical and traffic conditions at congested or accident prone locations, followed by appropriate actions or recommendations.

4. Research and study to develop and appraise new techniques, regulations, devices, and designs.

5. Cooperation with others (state, Federal, local and private) to achieve high, uniform standards in operating practice and safety measures throughout the state.

6. "Feed back" of knowledge obtained by experience, study and research to all functions in the department for the purpose of obtaining increasing improved standards in each function.

There are three fundamental requirements for the performance of an adequate program. They are:

- \* Legal authority to adopt traffic regulations for the highway system (Recommendations for legislative correction have been made)
- \* A specific unit with responsibility for the major functions (This memorandum recommends corrective action by the Department)
- \* A qualified staff with initiative, imagination and engineering competence. (Staff is available in the Department but not assigned to these duties)

Legal Authority

Under existing New Jersey law the State Highway Commissioner may enact certain traffic regulations for highways under his jurisdiction, but these regulations do not become effective or enforceable until approved by the Director of the Division of Motor Vehicles.

Insofar as the State Highway System is concerned, the current situation has many drawbacks. Many regulatory measures are integral parts of highway or street improvements so that the Division of Motor Vehicles is frequently in a post facto position of reviewing highway design. Furthermore, the decision to use certain traffic measures or control devices may be an alternative to construction or reconstruction based on availability of highway funds. Since the control of highway funds rests with the Highway Department, the Director of Motor Vehicles cannot properly approve or disapprove such decisions.

Strict interpretation of the legal definition of responsibilities and authorities now calls for two separate staffs -- one in the Highway Department to determine what is needed, one in the Division of Motor Vehicles to review for approval. Relationships between the Highway Department and the Division of Motor Vehicles have varied in character over the years. At least two Executive Orders have dealt with their relationships in an effort to develop an equitable, efficient assignment of duties.

Under terms of Executive Order No. 31 (November, 1951), the Traffic Engineering Staff of the Highway Department was transferred to the Bureau of Traffic Safety, but under terms of Executive Order No. 11 (April, 1955), they were returned to the Highway Department and the Director of Motor Vehicles now approves regulations enacted by the Commissioner of Highways -- pro forma.

#### The Present Situation

The net effect has been to create an atmosphere of uncertainty between the two agencies, to suppress operating functions in the

Highway Department and to slow down the whole process of regulating, guiding and assisting motorists in the use of highways.

In this atmosphere of uncertainty and instability, the Highway Department has shown an understandable reluctance to develop the strong operating unit and qualified, experienced staff to perform the operation functions. The functions are scattered through five bureaus and three divisions with no common supervision below the State Highway Engineer.

Although a considerable effort has been directed toward the speedy enactment of traffic regulations and the placing of traffic control devices since the April 1955 Executive Order, there are evidences of further needs which have accumulated over a long period of time. While the Department is aware of these deficiencies, it is not now able to cope with them. The highway system is generously decorated with directional signs of ancient vintage with such a multiplicity of messages in small letters as to be almost worthless at today's speeds and volumes. Many of them are neither illuminated nor reflectorized so they are illegible at night. Even a great many warning signs are not fully reflectorized for night visibility when their potential value is the greatest. A recent (August, 1958) report by the Department estimated about \$600,000 would be needed to modernize directional signing on the system; complete modernization would probably exceed \$1,000,000.

Furthermore, accident records and other information are not brought together to determine where action is needed to reduce hazards and congestion. In the absence of central control and direction of the operation functions, the Department has lost the initiative in operating matters. Congestion of state highways,

particularly in cities and municipalities, continues to rob New Jersey citizens, industry and business through lost time, delays and accidents.

Most of the operational measures which the Department takes are "spot" treatments. Confronted with staggering traffic volumes on urban and suburban highways, the Department has no "operating plans," no planned attack on problems of safe and efficient use of its highways.

Continuous observation of the highway system is not assigned as the specific responsibility of any of the four bureaus performing traffic functions. Accident rates for the system have not been calculated for several years. Most traffic studies are conducted in response to requests from private persons or public officials. The Bureau of Traffic Safety which processes approximately 30,000 accidents on the highway system each year has flagged for special study nearly 1,000 locations which appear to have high accident histories but no action has been taken on most of them.

Directional signing is the responsibility of the Sign Engineer, who is located organizationally in the Office Section of the Bureau of Road Location and Design. All signs must be approved by him before they can be erected. Actual erection and maintenance are the responsibility of the Signs and Traffic Lines Section of the Bureau of Maintenance. This, of course, includes warning and regulatory signs as well.

Recent revisions to signing practice and an expanded program are evidence of the Department's desire to improve its work.

Further efforts in this general field should be made. This activity should be combined with other traffic functions currently performed by the Bureau of Planning and Traffic and others. Thus, related field studies could be made by field forces under one supervisor.

Traffic signals are designed by the Traffic Control Section of the Bureau of Planning and Traffic and the Bureau of Electrical Operations. This arrangement appears to be mutually satisfactory. The division of responsibilities based on specialized skills is workable and effective. Installation and maintenance is the responsibility of the Bureau of Electrical Operations.

All traffic signal installations must be approved by the Director of Motor Vehicles.

Traffic regulations are prepared for the Commissioner's signature by the Traffic Safety, Control and Regulations Section of the Bureau of Traffic and Planning following studies to determine need. They must be approved by the Director of Motor Vehicles before they become effective.

Pavement markings are placed by the Signs and Traffic Lines Section of the Bureau of Maintenance which is also responsible for the placement and maintenance of traffic signs. Marking layouts are prepared for certain interchanges and intersections by the Bureau of Planning and Traffic. No passing zones are similarly specified after a regulation has been enacted and approved. This requires a written description of each zone after a field study.

Driveway control, an important consideration in the safety and capacity of a highway, is the responsibility of the Bureau of Permits which issues permits for utility locations and pavement

openings as well. In every case, these have an influence on the operating safety and convenience. Admittedly, the degree of influence varies considerably, but the over-all importance is such that this activity could well be placed under the same supervision as the other traffic functions to assure that operating considerations will be given full weight in issuance of permits.

Research is conducted at a high level by the Traffic Design and Research Section of the Bureau of Planning and Traffic. If the changes recommended herein were carried out, certain duties of this section which are essentially planning in nature would probably be assigned to other units leaving this section free to assist in developing standards and practices for the traffic functions.

Cooperation with other street and highway agencies in traffic operations is not particularly good. As a result of the dispersal of the traffic functions in this Department, no one unit has emerged as the spokesman for the Department in operating matters, nor has the Department a leadership position in these matters in the state. The Department does not assist municipalities in operating studies since this is a function of the Division of Motor Vehicles.

To correct the current situation will require changes in both the law and the organization of the Department.

Two major changes in the law have been recommended. These would give the Commissioner of Highways full authority to enact traffic regulations on the State Highway System and require him to establish, and keep current, standards and uniform practice for the entire state.

Organizational changes to complement the legal authority should be made immediately. A Division of Traffic Engineering should be created in headquarters, and district traffic engineering staffs should be assigned to each of the field districts. The headquarters unit should be made responsible for technical control of work functions, and preparation of standards, practices and policies. Headquarters should retain the functions of research and review and processing of regulatory measures.

The headquarters unit would consist of three bureaus: Traffic Design, Traffic Studies and Research, and Permits.

The Traffic Design Bureau would assume responsibility for design of traffic control devices as well as the preparation of specifications and standards for the design of traffic control and lighting facilities and measures. It would also be responsible for geometric design of related traffic improvements such as intersection channelization.

The Traffic Studies and Research Bureau would assume responsibility for traffic studies (now dispersed through several sections in different bureaus of the Department), the review, for adequacy and conformance with standards, of district recommendations for traffic control facilities and measures, and the preparation of operational plans for routes and areas in cooperation with the district offices. It would also assume responsibility for a program of traffic research.

The Permits Bureau would assume responsibility for issuance of permits for access and pavement openings.

District offices would assume direct responsibility for the conduct of all traffic studies, would initiate channelization and redesign, and would determine the need for and recommend all traffic control facilities and measures, would grant and inspect permits for access and pavement openings, would draft all recommended regulations and would develop detour and traffic handling plans on construction and reconstruction projects, and would make sure that they were properly carried out. The district offices would perform their duties under the policies, practices and procedures and in accordance with work programs approved by headquarters.

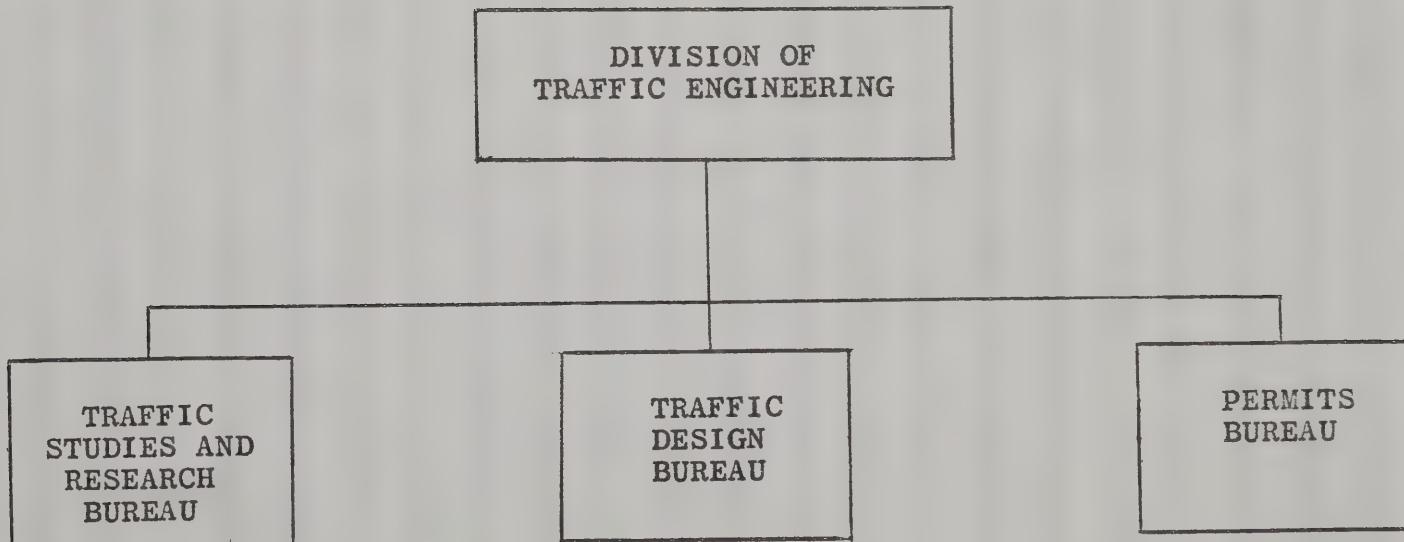
The duties, responsibilities and relationships of each of the headquarters sections and the district offices is further explained in the appendix to this memorandum entitled "Duties and Responsibilities of the Traffic Engineering Division."

The proposed headquarters organization is shown in Figure 1. It is estimated that 17 engineers of various grades will be required to staff this unit. Total requirements would include seven technicians (statisticians, draftsmen and aides) and approximately 15 clerical employees (clerks, typists and secretaries).

The field district offices could be organized in two basic units, field and office. Staff requirements there would vary depending on local conditions. Available information indicates that the four district offices would require a total of 16 engineers supported by ten to 15 technicians and draftsmen. Clerical staff in district offices were not estimated but it is certain that they would not be large.

Figure 1

PROPOSED ORGANIZATION  
TRAFFIC ENGINEERING DIVISION



## APPENDIX

### Duties and Responsibilities Of The Traffic Engineering Division

#### Traffic Design Bureau

1. Review geometric plans for proposed construction and reconstruction --

This bureau should review geometric plans at the time they are initially proposed and advise the division chief on questions of operational feasibility, general traffic control and lighting requirements, integration with operations of the adjacent street system and traffic handling during the construction period.

2. Complete traffic control plans for construction and reconstruction projects --

Where traffic control devices are to be included in a construction project, this bureau will prepare traffic control plans showing the location of all such devices.

3. Prepare channelization and intersection redesign plans on minor improvement projects --

When channelization and intersection redesign projects originate in the Traffic Engineering Division, the Design Bureau will complete the geometric design in sufficient detail to establish all geometric controls necessary for preparation of contract plans and specifications. In the event that construction is to be by

maintenance forces, the Traffic Design Bureau will prepare complete plans.

4. Design traffic control equipment and devices --  
The bureau will design all non-electrical traffic control devices. Also the bureau will cooperate with the Electrical Operations Bureau on the design of traffic signal equipment, mounting devices, illuminated signs, highway illumination, and other traffic control equipment not available as standard manufactured items. In design of such electrical installations this bureau will specify the location of all devices and their operational features. The Electrical Operations Bureau will then develop a design which will provide these operational features. In this work it will be guided by standards prepared by the Bureau of Public Roads, American Association of State Highway Officials, Joint Committee on Uniform Control Devices, and standards established by the Department.
5. Provide a central drafting service for all bureaus of the division.
6. Develop and prepare specifications and standards for all traffic control and lighting equipment --  
In the preparation of specifications, this bureau shall obtain from the Electrical Operations Bureau and the Maintenance Division information on desired electrical, mechanical and maintenance features.

7. Prepare and publish standards, manuals, and reports relating to the use, location, operation, design, performance and maintenance of channelization and traffic control and lighting equipment.

8. Undertake special assignments --

This bureau will assist the division chief in special assignments relating to design.

Traffic Studies and Research Bureau

1. Tabulate and analyze data on traffic accidents for all bureaus and district offices, ascertain data needs and design a program which will fulfill those needs within the limitation of available data. This bureau will coordinate its efforts with the Motor Vehicle Division and state and local police. It will not duplicate the efforts of others but will apply available data to highway problems.
2. Establish procedures for traffic studies leading to the determination of need for traffic control and lighting facilities and measures.
3. Process complaints and requests concerning traffic control facilities and measures -- providing this can be done without field study.
4. Review for approval drafts of all recommended traffic regulations.

5. Establish policies, practices and procedures for the issuance and inspection of permits for driveway, pavement openings, use of right of way and encroachments.
6. Develop operational plans for routes or areas --  
It is the responsibility of this bureau to prepare operational plans for areas or routes. Such plans shall encompass physical reconstruction and traffic control measures and regulations including such measures as one-way streets, through streets, major signal programs, off-center control, mass transit, truck, and convenience of travel in a specific area or over an extended section of street or highway. In addition, the bureau will develop parking controls or prohibitions to increase route capacity. Although some assignments of this nature may result from requests by officials or citizens, the major responsibility of the bureau will be to detect and correct operational deficiencies on an area-wide basis before they become a major detriment to efficient travel. They will rely on district forces to assist in obtaining necessary field measurements and data.
7. Develop a program for street and highway lighting.
8. Develop a systematic surveillance program --  
The bureau will determine the need for periodic traffic survey coverage and define (in terms of travel time, speed, accidents and other measures) tolerable

levels of service, sections of highways which fall below these levels are automatically eligible for detailed study. Isolated, unsatisfactory locations detected by this program would be referred to district offices for correction but the responsibility for the program and for major corrective action would reside in this Bureau.

9. Coordinate traffic control plans with adjacent states --  
This Bureau will be responsible for cooperation with the adjacent states and toll highway authorities in the development of area-wide traffic control plans.
10. Conduct and sponsor traffic research --  
The research program undertaken by this bureau should be oriented primarily to studies of the unknowns of traffic characteristics and behavior and their effects on geometric and control features.
11. Conduct studies to evaluate the effectiveness of traffic control devices and measures --  
These studies should be initiated by the Studies and Research Bureau but the bureau may call upon district offices to assist in the collection and compilation of data.
12. Propose standards for geometric design --  
When geometric design standards are proposed, the proposal shall be supported by research or studies of operating conditions at existing locations.

13. Process traffic regulations and maintain and keep current files of traffic regulations and Commissioner's orders relative to the bureau's activities --  
This bureau will prepare all final drafts of traffic regulations for signature by the Commissioner, following review and approval by the Traffic Design Bureau.

14. Maintain central files --

This bureau will be responsible for maintaining a central location file as a repository for all correspondence, studies, investigations and other reports pertaining to the work of the division. The bureau will prescribe forms and procedures to be followed by the other bureaus to achieve this end. The bureau will coordinate this activity with the central files of the Department so that the division records and files will complement those of the Department.

Permits Bureau

1. Establish policies, practices and procedures for the issuance and inspection of permits for driveways, pavement openings, use of right of way and encroachments.
2. Assist district offices as necessary on problems related to issuance and inspection of permits.
3. Maintain adequate files and records of permits issued.
4. Maintain liaison with Department legal counsel for

legal interpretations and assistance related to permit issuance and enforcement.

District Traffic Engineering Offices

1. Determine need for, and recommend, traffic control and lighting facilities and measures:

- a. Traffic regulations
- b. Traffic signals, signs and markings
- c. Channelization
- d. Transit and trucking routes
- e. Illumination
- f. Parking controls

Traffic studies will result from official and public requests, routine surveillance, referrals from other bureaus, police and maintenance reports, and personal observation. Studies will result in recommendations based on application of engineering principles, warrants and standards. They will be accompanied by drafts of necessary regulations, complete with justification, for Commissioner orders.

District Traffic Engineering offices will be accountable to the District Engineer. The major portion of their recommendations should be approved and implemented at the district level.

2. Process complaints and requests concerning traffic control and lighting facilities and measures --

Complaints and requests concerning traffic control and

lighting facilities and measures will generally be referred to the district. It will be the duty of the district to make such personal contacts and traffic studies and prepare such recommendations or take action as appropriate.

3. Prepare drafts of all recommended regulations --  
It will be the responsibility of this district to prepare, for action by the Commissioner, drafts of all recommended regulations dealing with traffic control matters. Final drafting and processing will be done at headquarters.
4. Initiate redesign of traffic control facilities and channelization of minor betterment projects --  
When the district, as the result of a traffic study, recommends signalization or redesign of an intersection or section of highway, it will provide sketches and operational requirements suitable for evaluation of the proposal and final preparation of plans and specifications for the design, purchase and installation of the traffic control facilities. Final preparation of the design will be carried out by the Traffic Design Bureau in cooperation with the Electrical Operations Bureau in the case of traffic signals and lighting.
5. Issue and inspect permits for constructing driveways, pavement openings, use of right of way, and encroach-

ments --

It is the responsibility of the district to take such steps or to make such recommendations as are necessary for the safe and efficient movement of traffic on the street and highway system as part of the process of granting and inspecting permits. In the case of pavement openings and encroachments, this may involve the development of traffic handling plans, or detour routes. In other cases, it may involve temporary or semi-permanent parking prohibitions or special signs, signals, markings, channelization or redesign.

6. Develop details of detour and traffic handling plans (including necessary shop orders and sign location plans) for construction and reconstruction projects, and any other street closures --

In the case of construction and reconstruction projects, traffic handling plans and detours will generally be initially suggested by the Traffic Design Bureau. It is the responsibility of the district to develop necessary details and shop orders complete with sign location plans for the erection of the necessary signs, signals and markings and to recommend and draft necessary traffic regulations.

7. Inspect detours during construction for adequacy of handling traffic and recommend or initiate necessary improvements.

8. Coordinate traffic control activities with local officials, state and local police, public transit companies and other transportation agencies.
9. Specify, and write shop orders for, the location of all signs, pavement markings, and parking prohibitions on construction and reconstruction projects when they near completion --

The district will be responsible for providing sufficient information for the erection or placement of all signs and pavement markings on new construction projects when they are near completion. Preparing for Commissioner's action new or revised regulations for the completed project will also be the responsibility of the district.

Shop orders will include all necessary detail to schedule work and material and complete the installation without obtaining additional measurements or information in the field.

10. Recommend research or studies of the use, performance, design and effectiveness of traffic control and lighting facilities and measures --  
It is the responsibility of the district to determine research and study needs related to their own duties and to recommend such research or studies. The responsibility for scheduling conducting such studies rests with the Traffic Studies and Research Bureau. The districts will assist in collecting and analyzing data as requested by the headquarters units.

VI Land Acquisition

VII State Aid

VIII Budget Practices

IX Public Information



## LAND ACQUISITION

In measuring the procedures and practices of the Division of Right of Way, Acquisition and Titles, with national standards, we find that New Jersey ranks better than average.

With the few exceptions pointed out in the separate legal study, the legislature has provided the Department with adequate law.

Efficiency of the land acquisition function, however, could be improved by changes in the Bureau of Titles and by establishing a good training program for the Division.

### Bureau of Titles

The function of the Bureau of Titles is to examine title to land acquired; to arrange for the clearance of title by the removal of encumbrances and other legal obstacles, prepare instruments of conveyance and generally perform all the work necessary to vest good and valid title in the state.

The present regulations require a complete 60-year search of title made on all land in excess of \$1,000 and 20-year search on all land values less than \$1,000.

Recently the firm of Peat, Marwick, Mitchell & Company, Certified Public Accountants, made a review and cost analysis of the operation of the Division of Right of Way.

That report made two major recommendations for reducing the costs of title searches: (1) Contract more title searches to

private firms engaged in that work; and (2) increase from \$1,000 to \$5,000 the values of properties for which only 20-year instead of 60-year searches are to be made.

The Foundation agrees with those two recommendations and urges their continued consideration as a means of reducing the size of the Division of Right of Way, Acquisition and Titles.

Training Program

The division has not developed an adequate training program for new employees. The only instruction given new personnel is by having them work with regular employees. While this type of instruction is necessary to develop practical experience, there is a need for additional instruction such as plan reading, public relations, land acquisition, law, etc.

Under the present method of training, it takes several months before the employee is competent to act on his own. If he had further training, he would be able to be of real service, quicker and more efficiently. The Department should establish a suitable training program and develop an up-to-date manual of instruction.

The right of way training material developed by the Right of Way Committee of AASHO should be helpful in starting a training program in New Jersey.

VII State Aid

VIII Budget Practices

IX Public Information



## STATE AID

The Division of State Aid administers and supervises financial assistance for road purposes to counties and municipalities under appropriations by the legislature. There are 588 governmental units eligible to receive these aids which amount to about \$16 million per year.

There are three separate state-aid programs -- one for aid to counties and two for aid to municipalities. The fund for aid to counties and one of the funds for aid to municipalities (formula fund) may be used either for construction or maintenance. The other municipal-aid fund, amounting to \$2 million annually, may be used only for construction.

Funds used by local units for construction are subject to plan approval and construction inspection by the State Aid Division. Because of these controls, most of the \$14 million allocated annually under the county aid and municipal formula fund programs is utilized for road and street maintenance, with local units using their own money for construction.

Administration of the funds consists of three major responsibilities: allocation of funds according to legislative formula, approval of programs for the expenditure of allocated funds, and inspection and approval of work accomplished.

The Division spent approximately \$700,000 in 1958 in administering the three funds. This is about four and a half percent of the funds administered. The Division estimates that 20 percent of

its efforts go to administering the county state-aid fund, 30 percent to administering the municipal formula fund and 50 percent to administering the municipal construction fund. If those estimates are reasonable, the Department spends one and a half percent to administer the county aid fund, four and a half to administer the municipal formula fund and  $16\frac{1}{2}$  percent to administer the municipal construction fund.

It is obvious that administration of the municipal construction fund is too expensive. There are other ways to accomplish reasonable supervision of those funds. However, other ways involve the entire concept of state aid and what it is supposed to do.

State aid is not, and should not be, only a convenient device for returning tax moneys to local divisions of government. In the highway field it should be used to assure the orderly and logical development of a total highway transportation system. The Department, in its administration of these funds, should be taking the necessary steps to achieve that objective.

First, the Department should encourage the selection of a system of roads of local importance which will provide a maximum of transportation benefit to the communities which, taken together, make up the whole state. It is to the improvement of these selected roads that state aid should be directed.

Second, the Department should be taking leadership in developing strong local highway departments and procedures for intergovernmental cooperation at the local level. Each county

is required to have an engineer. Many cities have qualified engineers. These engineers should be made an integral part of over-all highway administration in New Jersey. For instance, progressive administrative thought leads to the logical conclusion that it would be cheaper for the Department to turn over responsibility for the supervision of small construction funds to county engineers than to do the work itself. It should be made legally possible for the Department to pay for these services. This would strengthen local highway departments and establish the principle of intergovernmental cooperation in efficient highway operations.

There are notable examples already in existence of this type of local road management. Minnesota, Washington, Michigan and California are states which stand out, legislatively and administratively, in providing leadership in coordinating and improving local road management.

The Foundation recommends that the Department's part in state-aid administration be carefully and thoughtfully reviewed in the light of above comments and redirected to better achieve the fundamental objectives of the state's aid to local communities.







## BUDGET PRACTICES

The basis for sound financial planning and spending is establishing and maintaining a budget program composed of carefully prepared estimates of income and expenditures. Budget determinations require the close cooperation of the administrative officials concerned. Beyond budget preparation is the need for keeping the budget alive and useful by adopting a system of reporting and control to show the status of operations in relation to the financial plan at given periods.

Following are recommendations for changes in budget procedures in the Department, which will be helpful in both the present organization and the suggested reorganization. In the proposed reorganization the work would fall under the Budget Division under Finance and Administration. In the present organization the Comptroller has these responsibilities. (See charts in Section I.) The firm of Peat, Marwick, Mitchell & Company have reported to the Commissioner on accounting procedures in the Department. This area therefore was not studied in the review of budget practices.

### Budget Preparation

"Operating Procedures No. AD 22" (4/1/58) sets forth the steps for preparing the departmental budget. According to interviews in New Jersey the procedure is followed in general, which should result in close cooperation among top administration, engineers and the budget office. However, in actual practice, preparation is left mainly to the Comptroller. Consequently,

there is little understanding on the part of the engineers as to the uses and limitations of a budget, as a financial plan. The widely separated and highly specialized nature of the fields of engineering and accounting calls for good communication for understanding. When the engineers and administrators do not realize what the budget can do for them, they avoid it, rather than use it. On the other hand, if the budget officer understands the needs of the engineers he can prepare information in a manner helpful to them.

Serious attention should be given to achieving the state's objective of a program budget. Definite programs should be decided on to carry out the functions of the Department -- such as construction, maintenance, etc., and accounting records set up so that all applicable charges would apply to the proper functions. The Department does not define definite programs, a first step set up by the Budget Bureau. For example, where is the budget on maintenance, a large and important segment of a highway department budget? Presently it is included under the general R-10 account. In preparing the 1959-1960 budget the State Budget Bureau asked for better information on work load data, but according to interviews in New Jersey little has been accomplished.

All the steps toward a program budget will be helpful -- determining definite programs within the department, what costs should go into those programs, the numbers of people needed to carry them on, and a possible reduction in the number of object items now used for budgeting. In Maryland, where a performance

(or program) budget is in operation, the number of line items were reduced from 44 to 13 for budget purposes. The program can be carried on through the State Budget Bureau which has the stated objective of working toward the program budget.

As for the general form of the budget, a summary showing all programs of the Department should be prepared. At the present time, there is no place where the five accounts, R-10,-12,-14,-20 and -110 are brought together. The line-item justification sheets which are now used serve only to confuse the reader.

The use of dollar signs should be reduced to a minimum and figures can be rounded off, including expenditures, at least to the nearest dollar, and the decimal following rounded off figures should be dropped. This is a time and labor saving device.

#### Budget Execution and Control

The quarterly "Expenditures and Commitments" report should be revised to make the information more useful to operating divisions.

This is an example of what can be done to improve communication and understanding between engineers and accountants. This voluminous book has a wealth of information but the administrator and engineer have to adapt it to what they want to know. With good understanding between the groups, and with the ability of the Comptroller and the information he has available, he could produce the information in a form needed by people other than finance people. Without such communication, time and effort

are wasted.

In addition to understanding of needs, there must also be changes in record keeping to make the information available shortly after the period closes. Unless the figures are up to date, they are useless because decisions dependent on them must be made without them.

What format should the monthly or quarterly report take? This can be a first step in communications among administrators, engineers and the budget office. They should sit down together and decide this important question. All groups will learn from the process.

For accurate divisional budgeting, accounting records should show costs by organizational groupings. Changes should be made as the organizational pattern changes. Traffic engineering costs, for example, now are spread among several divisions. When reorganization is effected, accounting changes should be made to bring costs of traffic engineering under one heading. Another case needing correction is the budget for State Aid to Counties and Municipalities which contains the Bureau of Federal-aid Secondary Roads. Organizationally, that bureau is under the Division of Roads.

The Comptroller is charged with responsibility for reporting on current status of budgeted programs, including, of course, the construction program. In order to do this accurately he should receive up to date information on changes in the program. It was reported during interviews in New Jersey that this reporting system did not operate. The Comptroller had to

make individual contacts with those in charge of phases of the program to learn current status at a specific time. A reporting system should be worked out through conferences between the affected engineers and the Comptroller.

Summary of Recommendations

Top administration, engineers and the budget office should work closely in budgeting.

The state's objective of achieving a program budget should be implemented in the Department.

A general summary of the budget should be set up to show the planned costs in one place.

Dollar signs can be dropped and amounts rounded off without use of decimal, as time-saving devices.

The quarterly "Expenditures and Commitments" report should be studied by administrators and revised in the light of the needs of administration.

Divisional budgets should reflect charges for all costs under their jurisdiction and changes should be made as organizational changes are effected.

The budget officer must have accurate up to date information on changes in the budgeted program. The most efficient reporting system for this information should be worked out through conferences between engineers and the Comptroller.







## PUBLIC INFORMATION

One of New Jersey's biggest businesses is run by the State Highway Department.

Almost a billion dollars has been invested in the highway plant (for roads and bridges alone) since 1945 and projects planned this year will cost in excess of \$100 million. Investment needed in the next two decades amounts to almost \$3 billion. Direct employment by the Department averages some 3,500 men and women -- and this does not include the large forces on the payrolls of contractors and engineering firms.

This huge enterprise is financed by New Jersey citizens. They are entitled to know how their money is being spent, the extent of future needs, what services they are getting for their money and what services they may expect in the years ahead which are to bring fantastic increases in traffic. Also, the public has a stake in progress and development of the State Highway Department itself. Knowledge of all those factors is essential to the Department's effort to serve the people.

The public information function in the Department now is being capably handled, even though staff is limited and the information unit lacks firm status.

Foundation review shows that while several activities are regularly and adequately performed, others are necessarily neglected. Routine news releases are issued, leaflets explaining

technical and management problems are prepared, press interviews are handled or arranged, general statistics are prepared, photography is well utilized, and other activities are handled from time to time, such as preparing the state highway map.

Public information activities at present may be classed largely as the routine or "must" duties. A wide gap exists between what is provided the public and what the public should know. This situation arises from the shortage of capable assistants. Little time is available for planning ahead and for developing feature stories for newspapers and magazines. For example, a needed feature story on a route in northern New Jersey has been long delayed because of the lack of time to locate the facts.

Highly desirable functions needed include:

Annual Report A popularized annual report, quickly and forcefully covering the year's activities, could be an extremely helpful tool in gaining public understanding and support.

Hearings Hearings on proposed projects and locations are not attended by the public information staff. Opportunity is thereby lost to improve presentations and to work with local newsmen and photographers.

Speeches Present practice of the Department is not to use this medium except in cases of major meetings. A program of planned speeches

before the wide variety of responsible civic clubs and groups is one of the best ways to reach directly large numbers of influential people.

TV and Radio These media are not often used, because of lack of time and because of the belief they are not productive. They can be made productive, however, when live subjects are covered and good speakers are provided on well-planned programs.

Feature Stories As indicated earlier, time does not permit much effort in this extremely productive field. The story behind the story gives the Department opportunity to express its beliefs and philosophy.

Models The public information unit is doing an excellent job of building models of proposed projects. These, which are costly to build, generally are used only for showing to local officials for their guidance. Display of the models, with suitable placards, in bank and store windows and elsewhere would be profitable for the Department and would extend their usefulness.

House Organ At one time the Department published a magazine for employees. This service to employees should be revived, for only through such a publication can workers understand the activities, problems and aims of the Department. Informed

employees form the nucleus of an agency's public information program.

Present Status

The Bureau of Public Information lacks firm positioning in the Department organization. This is indicated by the fact that the actual head of the function is the Assistant to Commissioner who has duties other than those concerning public information. An acting or assistant director of the bureau is in immediate charge and supervises or does a very large part of the work; however, his civil service status is uncertain.

In addition to the above, staff includes one writer; a photographer, much of whose work is not related to public information; a model builder whose work has some public information significance but is not used to the best advantage; a draftsman who does some art used in public information but mostly does maps or layouts of proposed projects for hearings; two ladies who do secretarial work and filing; and two men who prepare clippings daily for use of the Commissioner and do odd chores.

The present actual writing staff, therefore, consists of the Acting Director and one writer. Much of their work is concerned with scheduling the time of the photographer and of the model maker, and other activities, which are more in the line of general services to the Department.

Recommendations

1. Because of the inescapable responsibility of providing information to the public, and

because of the Department's rapidly increasing work load and need for public support, the Public Information Bureau should be solidly established, with positioning that would carry over from administration to administration in a manner comparable to major engineering divisions.

Required would be agreement with the Civil Service Commission on classification and pay. Today, capable public information men command salaries comparable to engineers in responsible positions. Public information, as it should be, is now under the close supervision of top management. However, as shown on the functional chart in the section of this report, "Organizational Structure and Personnel Problems," public information should be closely associated with engineering as well as with administration.

2. The bureau should be headed by a Director of Public Information who would supervise all production, plan the information program and work with and advise the principal administrative and engineering officials on matters concerning the public.
3. Functions of the Public Information Bureau should be broadened to include all activities described earlier, so that the people of the state will have full understanding of the Department's problems and objectives.

4. Staff should be augmented to meet adequately the responsibilities of the Department and to conduct a more positive rather than a routine public information program. Addition of two capable writers appears justified in view of the work load faced at this time.

NJDOT RESEARCH LIBRARY



3 4310 00003 7500

